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Energy Research Abstracts

Abstracts 52615–54451

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UNITED STATES DEPARTMENT OF ENERGY

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Energy Research Abstracts

Purpose

Energy Research Abstracts (ERA) provides abstracting and indexing coverage of all scientific and technical reports, journal articles, conference papers and proceedings, books, patents, theses, and monographs originated by the U.S. Department of Energy, its laboratories, energy centers and contractors. *ERA* also covers other energy information prepared *in report form* by federal and state government organizations, foreign governments, and domestic and foreign universities and research organizations. Foreign information is obtained through the International Energy Agency's 14-nation Energy Technology Data Exchange, the International Atomic Energy Agency's International Nuclear Information System, or nation-to-nation agreements. **Please note that *ERA* coverage of nonreport literature is limited to that generated by Department of Energy activity.**

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ERA is comprehensive in its subject scope, encompassing DOE's research, development, demonstration, and technological programs resulting from its broad charter for energy sources, supplies, safety, environmental impacts, and regulation.

The citations presented in *ERA* are available for online searching as records within the Energy Data Base. The current-year records are available on the Integrated Technical Information System (ITIS). The entire database is available through commercial online vendors.

Availability

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ERA is available to the public on a subscription basis from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. The subscription rate for 24 semimonthly issues is $184.00 for domestic subscribers and $230.00 for foreign subscribers. A single issue costs $27.00, domestic, or $33.75, foreign. Cumulative indexes are available from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. The GPO Stock Number is 061-000-00749-1 for the Volume 14 indexes.

Managing Editor, Audrey B. Smith
Technical Editor, Robert W. Rutkowski

Information Sources

The citations presented in *Energy Research Abstracts* are a subset of the worldwide energy information provided to the Office of Scientific and Technical Information (OSTI) through exchange agreements with foreign sources and through exchanges or contracts with U.S. organizations.

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4. **Author(s).** First 10 names in the data record are printed, then "et al." is listed.
5. **Author affiliation.** Only first one is listed, in parentheses after author(s) to which it applies.
6. **Collaboration,** if present.
7. **Corporate author(s)** identifying corporation responsible for document.
8. **Patent assignee and number** for citations of patent documents or applications.
9. **Journal title, volume, and issue** for citations of journal articles.
10. **Date of publication.** If not known, a processing date is in brackets.
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13. **Monograph title** if citation is an analytic (part, chapter, or paper) of a larger monograph.
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15. **Sponsoring organization.**
16. **Contract or grant number.**
17. **Secondary identifying number;** may be a conference number.
18. **Conference title, location, and date,** if applicable.
19. **Order number.** The "DE" order number may be used for ordering from NTIS or OSTI, as appropriate. The "TI" prefix is valid only at OSTI.
20. **Sources of availability** from which a copy of the document may be obtained; usually appear as abbreviations. (See information on following page.)
21. **Drop note** or explanatory statement.
22. **Abstract.**
23. **Subject descriptors.** Listed only if no abstract or only a brief statement is included.

Sample Citations

Report

18494 (DOE/ER/40438–T1) **[Development of a hydrogen and deuterium polarized gas target for application in storage rings]: Progress report.** Haeberli, W. Phys. VI collaboration. Wisconsin Univ., Madison (USA). Dept. of Physics. [1989]. 12p. Sponsored by DOE Energy Research. DOE Contract FG02-88ER40438. Order Number DE89007246. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This paper briefly discusses the Wisconsin test facility for storage cells; results of target tests; the new UHV...

Report Analytic

18500 (INIS-SU—69, pp. 30-32) **Transition energies in Ne-like ions. Correlation effects.** Vainshtejn, L.A. AN SSSR, Moscow. Fizicheskij Inst. 1988. (In Russian). In *Experimental and theoretical physics. Collection.* Order Number DE89780060. Available from NTIS (US Sales Only), PC A03/MF A01; INIS.

Kratkie Soobshcheniya po Fizike.; no. 6.

SILVER IONS/energy-level transitions; XENON IONS/energy-level transitions; CORRELATIONS; D STATES; E STATES;...

Journal Article

19055 **A theoretical and experimental investigation of long-pulse, electron-beam-produced rare gas plasmas.** Brake, M.L.; Repetti, T.E. (Energy Beam Interaction Lab. of the Dept. of Nuclear Engineering, Univ. of Michigan, Ann Arbor, MI (US)). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Plasma Science (USA)*, 16(5): 581-589 (Oct 1988). (CONF-881020–: Symposium on radiation physics, Sao Paulo, Brazil, October 3, 1988).

Visible emission spectroscopy (380-650 nm) has been performed on intense, electron beam (1 kA, 300 ns, 300 kV) produced Ar, Kr,...

Patent

18045 **Polarization of fast particle beams by collisional pumping.** Stearns, J.W. To Dept. of Energy, Washington, DC. USA Patent 4,724,117. 9 Feb 1988. Filed date 19 Oct 1984. vp. Available from Patent and Trademark Office, Box 9, Washington, DC 20232.

A method for polarizing a fast beam of particles by collisional pumping, comprising the steps of generating a beam...

How To Order from the Availability Sources

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Report literature, usually identified by an alphanumeric identifier at the beginning of a citation, is available from the sources listed in the citation (see example of element 20 on page iii). Often the sources are listed as abbreviations. Corresponding addresses are provided at right from which documents with these abbreviations may be ordered. When "OSTI" is given, **DOE and DOE contractors may order these documents from OSTI.** (However, check with your library or information organization which may require that orders go through them to OSTI.) The public should order from NTIS or from one of the other agencies listed in the citation. To expedite processing, an order form is provided in the back of this publication. NOTE: The order numbers provide quicker access for report ordering. Use the order number where possible.

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Books, conferences, and monographs The source for these publications is the publisher or the originating society, organization, or institution. DOE-supported conferences and individual papers reporting DOE-supported research may be available as reports from OSTI.

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How To Use the Indexes

Five indexes are provided for approaching the content of each issue of *Energy Research Abstracts*. Descriptions of entries in these indexes follow.

Corporate Author Index
The corporation, organization, or institution responsible for the issuance of the document is listed in this index. The entries are arranged alphabetically and provide the title and citation number of the reference. For example, the listing for the "Report" sample citation would appear as shown at right.

Wisconsin Univ., Madison (USA). Dept. of Physics
[Development of a hydrogen and deuterium polarized gas target for application in storage rings]: Progress report, 15:18494 (R;US)
Wisconsin Univ., Madison (USA). Lab. of Genetics
Organization of the R chromosome region in maize: Final progress report, June 1, 1983–May 31, 1986, 15:18255 (R;US)

Personal Author Index
Each author's name listed on a document cited in this issue is indexed. An index entry provides title and citation number; for secondary and other names, a cross-reference is given to the primary author name where the full index entry is located.

Hadley, D.L., *See* Lee, A.D., 15:17651
Haeberli, W., [Development of a hydrogen and deuterium polarized gas target for application in storage rings]: Progress report, 15:18494 (R;US)

Subject Index
This index lists the main subject descriptors assigned to each record by indexing professionals. A secondary or qualifier term is used where necessary to describe materials, objects, and processes. Document titles may be enhanced with additional informative phrases where necessary. An excerpt from this index appears at right.

HYDROGEN ISOTOPES
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Neutron-Rich Isotopes
Study on the strong neutron-rich nuclei of lightest elements, 15:18686 (RA;SU;In Russian)

Contract Number Index
DOE technical reports are listed by contract number. Each entry also provides the primary corporation or organization cited for that contract number. A typical entry is shown.

FG02-88ER40438 **Wisconsin Univ., Madison (USA). Dept. of Physics**
15:18494 DOE/ER/40438–T1
FG02-88ER60664 **Rogers and Associates Engineering Corp., Salt Lake City, UT (USA)**
15:17641 DOE/ER/60664–1

Report Number Index
Technical report literature is indexed by the alphanumerical identifier of the report. Patent documents and conferences are included for convenience. Each entry lists the citation number, the source of availability of the document, an indicator of presence at a GPO depository library, order number, and distribution category. A typical entry is:

DOE/ER/40438–T1 15:18494 NTIS, PC A03/MF A01 - OSTI E 1.99: DE89007246 MF-411

Subject Contents

The subject content of *Energy Research Abstracts* is arranged as shown below. The two-digit and four-digit category numbers printed here illustrate the category number assignment used in the database records.* The following list includes all of the 39 first-level and the 308 second-level categories. Because each issue of *ERA* publishes citations only for those documents announced during the past semimonthly period, some subject categories may not be present in every issue.

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*The numerical subject category scheme is used in the storage, retrieval, and manipulation of bibliographic information entered into DOE's data systems. Categories and definitions for the complete set of six-digit numbers are given in DOE/TIC-4584, *Energy Data Base: Subject Categories and Scope*.

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Energy Research Abstracts

01 COAL, LIGNITE, AND PEAT

52615 (VTT-SYMP–107) **Low-grade fuels: Volume 1.** Korhonen, M. (ed.). Valtion Teknillinen Tutkimuskeskus, Espoo (Finland). 1989. 376p. (CONF-890668–Vol.1: Symposium on low-grade fuels, Helsinki (Finland), 12-16 Jun 1989). Order Number DE91707607. Source: NTIS (US Sales Only), PC A17/MF A01.

The smposium on low-grade fuels was held in Helsinki on June 12-16, 1989. The Symposium was organized by the Technical Research Centre of Finland in cooperation with the Finnish Ministry of Trade and Industry. The occasion gathered together specialists from 19 countries to exchange experience and information about low-grade fuels. These fuels, for example, lignite, peat, wood, industrial byproducts, waste, etc., are in many areas important local energy sources. However, they have often a high moisture or ash content or a difficult ash behaviour, which make them low-grade fuels, although their organic constituents may be of prime quality. The common goal was to minimize operational problems and environmental consequences of using these difficult fuels. The programme consisted of an introductory session and of technical sessions on Combustion of Low-Grade Fuels, Gasification of Low-Grade Fuels, Behaviour of Low-Grade Fuels during Handling, Ash Behaviour and Environmental Aspects Related to the Utilization of Low-Grade Fuels. Poster presentations were also held.

0103 Preparation

Refer also to citation(s) 52658, 52692, 52949

52616 (DOE/PC/88881–T7) **Controlled comparison of advanced froth flotation process technology and economic evaluations for maximizing BTU recovery and pyritic sulfur rejection: Topical report No. 2.** Harrison, K.E. (ICF Kaiser Engineers, Inc., Pittsburgh, PA (USA)); Ferris, D.D.; Kosky, R.M.; Warchol, J.J.; Musiol, W.F.; Shiao, S.Y.; Luttrell, G.H.; Adel, G.T.; Yoon, R.H. ICF Kaiser Engineers, Inc., Pittsburgh, PA (USA); Consolidation Coal Co., Pittsburgh, PA (USA); Babcock and Wilcox Co., New Orleans, LA (USA); Virginia Polytechnic Inst. and State Univ., Blacksburg, VA (USA). [1990]. 168p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC22-88PC88881. Order Number DE91000989. Source: NTIS, PC A08/MF A01 - OSTI; GPO Dep.

The overall objective of this round robin project was to select the most efficient, as determined by the efficiency index, cost effective, as determined by the annual cost per ton of SO_2 removed, advanced flotation device available. This machine was to process ultra fine coal, maximize Btu recovery and maximize pyritic sulfur rejection. The device will first be installed as a one hundred pound per hour capacity unit and, subject to the outcome of Task 6 of the Engineering Development Contract, increased to a 3 ton per hour capacity unit for installation into a proof-of-concept preparation plant. All of the technical and economic results were submitted to the TST for consideration. The TST members evaluated the data and determined to rank each of the participants 50% on technical merit and 50% on economic merit. The technical merit was to be the efficiency index. The economical merit was to be the annual dollars per ton of clean coal corrected for carrying capacity and frother concentration and the results of Test No. 4. This factor does not penalize a particular technology for not meeting a 90% pyritic sulfur rejection and therefore leaves something to be desired as the only economic basis for decision. A second economic evaluation criteria was required that considered the $/ton of sulfur dioxide removed. The technical and economic factors were calculated and added together for the final evaluation ranking. The technical factor was calculated by multiplying the efficiency index for each participant by 0.5. The two economic factors were calculated by dividing 1000 by the $/ton of clean coal and multiplying by 0.5 and by dividing 10,000 by the $/ton of sulfur dioxide removed and multiply by 0.5. The 1000 and 10,000 are numbers selected such that when divided by their economic factors, respective numbers resulted in a two digit number. The results of these calculations are discussed. 4 refs., 18 figs., 27 tabs.

52617 (EUR–12076-DE) **Investigation of the disintegration of coal in the presence of additives to aid grinding.** Leonhard, J. Bergbau-Forschung GmbH - Forschungsinstitut des Steinkohlenbergbauvereins, Essen (Germany, F.R.). 1990. 91p. (In German). Source: Commission of the European Communities, Luxembourg.

The way in which the disintegration process is influenced by the addition of substances to aid grinding and by pretreatment of material for grinding was investigated using coal of a series of coal ranks. Tests were carried out using a single grain impact apparatus, a laboratory oscillating mill, a plant ball mill, a toothed colloid mill and a technical school ball mill. Methanol, ethanol, ethylene glycol and lignin sulphonate were applied for wet grinding and triethanolamine (TEA) for dry grinding. Pretreatment of the coal consisted of varying periods of storage in methanol and in water. The mode of action of grinding additives in coal grinding is determined by the surface structure, the cavity structure, the degree of cross-linkage of the coal macromolecules, and also the influence of the additives on the flow behaviour of the sludge of ground material. In wet grinding small additions of the grinding aids used bring about wetting of the entire coal surface and a reduction in the viscosity of the suspension of ground material. The resulting improved dispersion of fine material produced during grinding has a positive influence on friction and energy transfer within the grinding chamber and leads to a reduction in the energy needed to achieve disintegration during the grinding process. According to coal type and duration, storage of coal in liquids (methanol and water) causes swelling processes within the coal matrix, which are linked to the formation of new microfissures and a weakening of the bonds between coal and mineral intergrowths. In subsequent grinding this brings about a reduction in the energy requirement and an increase in the proportion of fine material and ash concentration in the coarse grain fractions.

52618 (EUR–12653-IT) **Industrial tests with spirals of different types.** Carbosulcis SpA, Cortoghiana (Italy). 1990. 73p. (In Italian). Source: Commission of the European Communities, Luxembourg.

Tests were conducted on spiral separators in the range 0.030 to 2.0 mm. They showed that in the size range 0.1 to 2.0 mm, the spirals could compete with slurry jigs in terms of separation parameters, ease of control, investment and operating costs. Separation efficiencies are tabulated.

52619 (IS–5008) **Mechanisms for selective agglomeration of coals: Quarterly report, April 1, 1989–June 30, 1989.** Wheelock, T.D.; Drzymala, J.; Allen, R.W.; Hu, Y.-C.; Tyson, D.; Xiaoping, Qiu; Lessa, A. Ames Lab., IA (USA). May 1989. 27p. Sponsored by U.S. DOE Fossil Energy. DOE Contract W-7405-ENG-82. Order Number DE91001300. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Work continued on the basic mechanisms which underlie various processes for beneficiating aqueous suspensions of coal by selective agglomeration with oil. A new method was demonstrated for characterizing the agglomerability of coal suspensions. This method utilizes a photometric dispersion analyzer to monitor changes in the turbidity of a particle suspension as increasing amounts of oil are added to the suspension in a batch agglomeration test. Agglomeration of the particles leads to a marked decrease in the turbidity of the suspension. Another experimental technique was also demonstrated for characterizing oil agglomeration. This technique involves measuring the rate of growth of agglomerates in a continuous flow system operating under stead-state conditions. The data are analyzed by means of a population balance. The results of a preliminary set of experiments in which Indiana V seam coal was agglomerated with tetralin seemed to fit a particular growth model very well. Equipment was also constructed for studying the kinetics of agglomeration in a batch process. While earlier work showed

that quebracho (a commercially available dispersant) is a strong agglomeration depressant for pyrite, recent experiments with mixtures of Upper Freeport coal and mineral pyrite showed that quebracho does not appear to be sufficiently selective. Further consideration was given to the separation of mixtures of coal and pyrite agglomeration with heptane. 2 refs., 17 figs., 1 tab.

52620 (OY/PSTL-TIED–69) **Evaporation from milled peat after rain and evaporation from peats of different qualities.** Tapanila, O.; Kiukaanniemi, E. Oulu Univ. (Finland). Research Inst. of Northern Finland. Feb 1990. 60p. (In Finnish). Order Number DE91707436. Source: NTIS (US Sales Only), PC A04/MF A01.

The aim of this research was to determine the effects of degree of humification, the species of vegetation and rain on drying of peat, the evaporation from different quality peats have been compared both in laboratory and on the field. The effects of rain has been studied by using different sprinkling tests with peat samples in laboratory. The test results have shown that the drying of peat is increased as the degree of humification is increased. Carex, Sphagnum and shrub contents of peat increase the drying speed of peat, but the buckbean content decreased it. While testing the effect of moisture content on drying of peat, the differences between evaporation efficiencies of different samples were largest with high moisture contents. In the tests drying of peat was slowed down notably with sprinkling of 3 mm or more. When the sprinkling exceeded 5 mm the drying time was slowed down just a little bit more. When sprinkling the peat samples repeatedly the drying of them took the same time when the sprinkling amounts were the same. Milled layers were dried faster in newish production sector there the ground water still was far below the surface of the field. This enabled 7-10 harvests during the tests, but in old production sectors the number of harvests was only 2-3. On the field the measured amounts of rain varied during measuring seasons of four and two weeks up to 30 mm on different sectors.

52621 **Controlling toxic emissions.** Boron, D.J. (USDOE Pittsburgh Energy Technology Center, Pittsburgh, PA (USA)); Wan, E.I. *Coal (USA)*, 95(6): 121,123,125,127,129 (Jun 1990).

Conventional coal cleaning can remove significant amounts of toxic trace elements, and advanced physical coal cleaning may have the potential to achieve even greater trace element reductions. The cleaning efficiency of various techniques can be coal dependent, with eastern US coals being more effectively cleaned than other US coals. For a large utility power plant, precombustion coal cleaning may reduce trace element emissions to levels which meet provisions of pending clean air plans. 25 refs., 1 fig., 4 tabs.

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Refer also to citation(s) 52651, 52695, 52696, 52697, 52698, 52699, 52700, 52701, 52703, 52913, 52949, 53185

52622 (CRIEPI-EW–89001) **Evaluation method of coal gasification combined cycle power generation plant's performance and gasification characteristics.** Moritsuka, H.; Mimaka, T.; Inumaru, J.; Hamamatsu, T. Central Research Inst. of Electric Power Industry, Tokyo (Japan). Oct 1989. 42p. Source: Central Research Institute of Electric Power Industry, Tokyo (Japan).

To evaluate coal gasification combined cycle generation plant's performance, a heat flow chart displaying energy transform process of total generation plant and performance indices is proposed in this paper. The equations are determined through mass and heat balances of an air-blown pressurized two stage entrained bed coal gasifier, a fixed-bed dry gas clean-up system, a gas turbine and a heat recovery steam generation system. Based on data of 2 ton/day gasifier, difference of gasification characteristics among several bituminous coals (of low ash melting point to high ash melting point) and improvement of gasification performance concerning gasifier capacity (2 ton/day to 4000 ton/day) are discussed. 9 figs., 4 tabs.

52623 (CRIEPI-EW–89002) **Characteristics of a 2T/D pressurized two-stage entrained bed coal gasifier.** Inumaru, J.; Hara, S.; Ashizawa, M.; Kobayashi, Y.; Hamamatsu, T.; Ishikawa, H.; Takekawa, T.; Ishigami, S.; Koyama, T. Central Research Inst. of Electric Power Industry, Tokyo (Japan). Jan 1990. 42p. Source: Central Research Institute of Electric Power Industry, Tokyo (Japan).

The experimental study using a 2T/D air-blown pressurized two-stage entrained bed coal gasifier was initiated in 1983. Various tests have been conducted for 15 bituminous coals well known in Japan. The summed up gasification time is 1320 hours (September 1988). This report presents the results of operational study and experimental tests for several coals. Many improvements have been made on the 2T/D coal gasifier. Owing to these improvements, a slagging problem at the gasifier outlet has been solved and steady discharge of molten slag under air blown conditions has been achieved also for over 1500°C high-ash melting coals. The performance of char recycle system has also been improved. Furthermore, the influence is revealed of coal variety and the air feed rate on gasification efficiency, as expressed by the product gas calorific value, carbon conversion efficiency, and cold gas efficiency. Trace gas (H_2S, COS, NH_3etc.) concentrations in the product gas were measured under various operating conditions. Based on experimental results, a variety of knowledge has been obtained that is useful for the design and operation of a large-scale coal gasifier. 8 refs., 35 figs., 12 tabs.

52624 (CRIEPI-EW–89007) **Characteristics fo a 2T/D pressurized two-stage entrained-bed coal gasifier.** Hara, S.; Inumaru, J.; Ashizawa, M.; Kobayashi, Y.; Hamamatsu, T.; Ishikawa, H. Central Research Inst. of Electric Power Industry, Tokyo (Japan). Jan 1990. 27p. Source: Central Research Institute of Electric Power Industry, Tokyo (Japan).

In the air-blown pressurized two-stage entrained-bed coal gasifier, the produced char is recycled for higher gasifying efficiency. The maximum efficiency is reached as all of the product char is recycled. Thus, from the viewpoint of design and operation of gasifier, it is definitely important to elucidate recycled char flow rate under the condition of product char all recycled. Using experimental data on a 2 T/D coal gasifier, this report elucidates effect of char recycle on gasifying efficiency and recycled char flow rate. This knowledge is directly applicable to large scale coal gasifiers like a 200 T/D pilot plant. If some necessary data can be obtained before or during operating gasifier, the target value of recycled char flow rate, one of the most important operating conditions is instantly cleared with type of coals and air ratio, during operating gasifier. 4 refs., 23 figs., 2 tabs.

52625 (CRIEPI-W–89007) **High intensity cleaning for porous ceramic filter in hot coal gas cleaning.** Central Research Inst. of Electric Power Industry, Tokyo (Japan). Sep 1989. 31p. (In Japanese). Source: Central Research Institute of Electric Power Industry, Tokyo (Japan).

This report relates to the performance of high intensity cleaning for the porous ceramic filter in hot coal gas tests. The results are are follows: High intensity filter cleaning is effective under high temperature high pressure conditions. However, since the cleaning effect depends on the reverse flow rate through the filtration surface, it is necessary to obtain a large reverse flow rate for effective cleaning. High filtration rates diminish the cleaning effect, so the optimum filtration rate must be set to design a filter unit. Scaling up the filter unit causes the pressure loss and filtration rate to be changed. Thus it is necessary to estimate these changes for the optimum design and operation of the filter unit. This report also relates to a simulation method for the changes. 5 refs., 21 figs., 1 tab.

52626 (CRIEPI-W–89009) **Computer analysis of two stage entrained bed coal gasifier.** Mimaki, T.; Hara, S.; Inumaru, J.; Hamamatsu, T. Central Research Inst. of Electric Power Industry, Tokyo (Japan). Sep 1989. 37p. (In Japanese). Source: Central Research Institute of Electric Power Industry, Tokyo (Japan).

A two-stage entrained bed coal gasifier has a feature that the entire coal gasifier can be operated at a low air content by controlling the coal and air feed rates to the combustor and the reductor section respectively independently. This paper describes the results of computer analysis on the different coal feed ratios to the combustor and the reductor before the test with the 2 T/D coal gasifier. Main results are as follows: We can expect a higher cold gas efficiency and calorific value at a lower combustor/reductor

coal feed ratio, with the temperature of the raw gas at the combustor section kept constant. In general, it is effective to lower the coal feed ratio with the entire air feed rate kept constant, for efficiently gasifying the high ash fusion temperature coal, but it is estimated that a high temperature cannot be obtained at the combustor section because the heat loss through the 2T/D gasifier wall tends to sharply increase at a lower combustor/reductor feed ratio. 4 refs., 17 figs., 2 tabs.

52627 (DOE/MC/22247–2859) **Design studies for gasification/hot gas desulfurization system operation in a load following mode: Final report.** Smith, D.P. General Electric Co., Schenectady, NY (USA). Research and Development Center. Jun 1988. 237p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC21-86MC22247. Order Number DE90009674. Source: NTIS, PC A11/MF A01 - OSTI; GPO Dep.

The prime objective of this project has been to perform design studies and develop conceptual and detailed designs for a hot gas desulfurization system for Simplified (IGCC) integrated gasification combined cycle electric power generation. The desulfurization system is designed so that the Simplified IGCC system can be operable in a load following mode to allow the power generation equipment to participate in grid load management. The project was conducted in two phases. Phase I has resulted in the conceptual design of a commercial-scale desulfurization system for a 50 MW utility electric power generation system. Based on this conceptual design, estimates were made of the cost of electricity such a plant would produce. Phase II developed a conceptual adaptation of that design concept to "proof-of-concept" scale for incorporation in an existing Process Evaluation Facility for experimental verification of the design. The desulfurization system design is based on the use of solid pellets of zinc ferrite ($ZnFe_2O_4$) as the sorbent. The hot coal gas desulfurization system design developed in this program consists of high-efficiency cyclones to collect entrained particles, a moving bed absorber containing zinc ferrite sorbent to remove sulfur compounds, a moving bed regenerator to regenerate the sulfided sorbent, a regeneration gas recycle system and a solids transport system. 26 refs., 49 figs., 17 tabs.

52628 (DOE/MC/24173–2898) **Design of a circulating fluidized-bed reactor for mild gasification of coal: Final report.** Huang, J.R. Mississippi Univ., University, MS (USA). Dept. of Chemical Engineering. May 1990. 95p. Sponsored by U.S. DOE Morgantown Energy Technology Center. DOE Contract FG21-87MC24173. Order Number DE90015342. Source: NTIS, PC A06/MF A01 - OSTI; GPO Dep.

A laboratory-scale Circulating Fluidized-Bed Reactor (CFBR) has been selected to best overcome the tendency for caking coals to agglomerate during the mild gasification. Several characteristics make the CFBR unit attractive for this use. These include the capabilities to use a high velocity fluidization, dilute solid gas stream, recycle solids, high solid throughputs, and to maintain an inventory of inert solids. A cold-flow CFBR unit has been built for studying the dynamics of particle flow within the reactor. Limestone, sand, and Nylon BB's have been chosen to characterize this unit. The optimal operation has been predicted for Pittsburgh No. 8 bituminous and Montana Rosebud subbituminous coal using the data from the cold-flow model. The scope of these studies is to present some of the reactor's design considerations and to describe the reactor. 18 refs., 12 figs., 7 tabs.

52629 (DOE/METC–90/4101) **Ground movements associated with large-scale underground coal gasification.** Siriwardane, H.J.; Layne, A.W. USDOE Morgantown Energy Technology Center, WV (USA). Sep 1989. 31p. Sponsored by U.S. DOE Morgantown Energy Technology Center. Order Number DE90009685. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The primary objective of this work was to predict the surface and underground movement associated with large-scale multiwell burn sites in the Illinois Basin and Appalachian Basin by using the subsidence/thermomechanical model UCG/HEAT. This code is based on the finite element method. In particular, it can be used to compute (1) the temperature field around an underground cavity when the temperature variation of the cavity boundary is known, and (2) displacements and stresses associated with body forces (gravitational forces) and a temperature field. It is hypothesized that large Underground Coal Gasification (UCG) cavities generated during the line-drive process will be similar to those generated by longwall mining. If that is the case, then as a UCG process continues, the roof of the cavity becomes unstable and collapses. In the UCG/HEAT computer code, roof collapse is modeled using a simplified failure criterion (Lee 1985). It is anticipated that roof collapse would occur behind the burn front; therefore, forward combustion can be continued. As the gasification front propagates, the length of the cavity would become much larger than its width. Because of this large length-to-width ratio in the cavity, ground response behavior could be analyzed by considering a plane-strain idealization. In a plane-strain idealization of the UCG cavity, a cross-section perpendicular to the axis of propagation could be considered, and a thermomechanical analysis performed using a modified version of the two-dimensional finite element code UCG/HEAT. 15 refs., 9 figs., 3 tabs.

52630 (DOE/PC/79935–14) **Circulation in gas-slurry column reactors: Final report.** Clark, N.; Kuhlman, J.; Celik, I.; Gross, R.; Nebiolo, E.; Wang, Yi-Zun. West Virginia Univ., Morgantown, WV (USA). Dept. of Mechanical and Aerospace Engineering. 15 Aug 1990. 257p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FG22-87PC79935. Order Number DE91000694. Source: NTIS, PC A12/MF A01 - OSTI; GPO Dep.

Circulation in bubble columns, such as those used in fischer-tropsch synthesis, detracts from their performance in that gas is carried on average more rapidly through the column, and the residence time distribution of the gas in the column is widened. Both of these factors influence mass-transfer operations in bubble columns. Circulation prediction and measurement has been undertaken using probes, one-dimensional models, laser Doppler velocimetry, and numerical modeling. Local void fraction was measured using resistance probes and a newly developed approach to determining air/water threshold voltage for the probe. A tall column of eight inch diameter was constructed of Plexiglas and the distributor plate was manufactured to distribute air evenly through the base of the column. Data were gathered throughout the volume at three different gas throughputs. Bubble velocities proved difficult to measure using twin probes with cross-correlation because of radial bubble movement. A series of three-dimensional mean and RMS bubble and liquid velocity measurements were also obtained for a turbulent flow in a laboratory model of a bubble column. These measurements have been made using a three-component laser Doppler velocimeter (LDV), to determine velocity distributions non-intrusively. Finally, the gas-liquid flow inside a vertically situated circular isothermal column reactor was simulated numerically. 74 refs., 170 figs., 5 tabs.

52631 (DOE/PC/80908–15) **Low severity coal conversion by ionic hydrogenation: Final report, July 7, 1986–December 1989.** Larsen, J.W.; Maiorielio, J.; Cheng, J.C. Lehigh Univ., Bethlehem, PA (USA). Dept. of Chemistry. 17 Aug 1990. 50p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FG22-85PC80908. Order Number DE91000920. Source: NTIS, PC A04/MF A01 - OSTI; GPO Dep.

The work accomplished in this project will be reported in two parts. Part one will focus on the development of catalytic ionic hydrogenation reactions utilizing a transition metal-H_2 complex as the hydride donor and BF_3:H_2O as proton donor. This part reports the results of preliminary work leading to the development of a new catalytic ionic hydrogenation system $(MeCN)_2PtCl_2/H_2/BF_3$: H_2O. The results from some of this work have been published and the paper is included as the appendix. The second part focuses on the newly developed catalytic and other well characterized ionic hydrogenation reactions applied to lignites (Beulah-Zap), sub-bituminous (Wyodak), and bituminous coals (Pittsburgh #8). 19 refs., 10 tabs.

52632 (DOE/PC/89866–T1) **Direct conversion of light hydrocarbon gases to liquid fuel: Quarterly technical status report No. 4 for first quarter FY 1990.** Foral, M.J. Amoco Oil Co., Naperville, IL (USA). Research and Development Dept. [1990]. 12p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC22-89PC89866. Order Number DE91000820. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Amoco Oil Company is investigating the direct conversion of light hydrocarbon gases to liquid fuels via partial oxidation. This report

describes work completed in the first quarter of the two-year project (first quarter FY 1990). Task 1 of the work, preparation of the Project Management Plan, has been completed. Work was started and progress made on three other tasks during this quarter: Task 2. Modification of an existing Amoco pilot plant to handle the conditions of this project. Minor modifications were made to increase the maximum operating pressure to 1500 psig. Other more extensive modifications are being designed, including addition of an oxygen compressor and recycle system. Task 3.1. Evaluation of a Los Alamos National Laboratory methane oxidation kinetic model for suitability in guiding the experimental portions of this project. Task 3.2. Process variable (e.g. temperature, pressure, residence time) studies to determine optimal partial oxidation conditions. 1 fig.

52633 (DOE/PC/90016–T8) **Production of jet fuels from coal-derived liquids: Volume 14, Oxygenates content of coal-derived jet fuels: Interim report, November 26, 1986–July 31, 1989.** Knudson, C.L. North Dakota Univ., Grand Forks, ND (USA). Energy and Environmental Research Center. Jun 1990. 56p. Sponsored by U.S. Department of Defense; U.S. DOE Fossil Energy. DOE Contract AC22-87PC90016. (AFWAL-TR–87-2042-Vol.14). Order Number DE91001313. Source: NTIS, PC A04/MF A01 - OSTI; GPO Dep.

Samples of jet fuel (JP-4, JP-8, JP-8X) produced from the liquid by-products of the gasification of lignite coal from the Great Plains Gasification Plant were analyzed to determine the quantity and type of organo-oxygen compounds present. Results were compared to similar fuel samples produced from petroleum. Large quantities of oxygen compounds were found in the coal-derived liquids and were removed in the refining process. Trace quantities of organo-oxygenate compounds were suspected to be present in the refined fuels. Compounds were identified and quantified as part of an effort to determine the effect of these compounds in fuel instability. Results of the analysis showed trace levels of phenols, naphthols, benzofurans, hexanol, and hydrogenated naphthols were present in levels below 100 ppM. 9 figs., 3 tabs.

52634 (DOE/PC/90523–T7) **Phase equilibrium data for development of correlations for coal fluids: Report for the period January 15, 1990–April 15, 1990.** Robinson, R.L. Jr. Oklahoma State Univ., Stillwater, OK (USA). School of Chemical Engineering. [1990]. 18p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FG22-86PC90523. Order Number DE91000695. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The effective design and operation of processes for conversion of coal to fluid fuels require accurate knowledge of the phase behavior of the fluid mixtures encountered in the conversion processes. Multiple phases are present in essentially all stages of feed preparation, conversion reactions, and product separation; knowledge of the behavior of these multiple phases is important in each step. The overall objective of the author's work is to develop accurate predictive methods for representation of vapor-liquid equilibria in systems encountered in coal-conversion processes. During the present report period, our solubility apparatus was modified to accommodate methane mixtures and to expedite data acquisition. The modifications resulted in a number of improvements including: improved mixing, low dead volume, and improved design and procedures for cleaning and degassing. Data have been obtained on the solubility of methane in cyclohexane and in benzene at 323.1, 373.1 and 423.1 K. These data are well described by the Soave and Peng-Robinson equations of state. 19 refs., 2 figs., 4 tabs.

52635 (EPRI-GS–6797) **Coal devolatilization in a moving-bed gasifier: Final report.** Thimsen, D.P. (Hamilton Maurer International, Inc., Houston, TX (USA)); Maurer, R.E. Electric Power Research Inst., Palo Alto, CA (USA); Hamilton Maurer International, Inc., Houston, TX (USA). ©Oct 1990. 133p. Sponsored by Electric Power Research Institute. Source: Research Reports Center, Box 50490, Palo Alto, CA 94303.

This report presents the result of a project to (1) assemble and evaluate a comprehensive coal devolatilization data base derived from laboratory, and from atmospheric and high pressure moving-bed gasification data, and (2) develop an empirical model to predict the yield and composition of the major devolatilization products (i.e., tar, naphtha, methane, hydrogen, carbon dioxide, and water vapor) in moving-bed gasifiers at elevated pressure. The computerized coal devolatilization data base contains data from Fischer-Schrader (FS) low temperature carbonization assays, from operation of an atmospheric Wellman Galusha gasifier, and from operations at seven different pressurized, moving-bed gasification facilities. Empirical regression equations fitted to properties from standard coal proximate and ultimate analyses successfully predicted product yields from the FS assay data, and the FS tar yield model was also an excellent predictor for the measured tar yields from the Wellman Galusha gasifier. Tar and naphtha yield models for pressurized moving-bed gasification were obtained by empirically modifying the FS assay correlation to include the effects of total pressure and hydrogen partial pressure in the gasifier devolatilization zone. Unfortunately, the proposed tar yield model had only a marginal fit to the sparse pressurized data available and there was not enough usable naphtha yield data to verify the proposed naphtha model. 97 refs., 19 figs., 15 tabs.

52636 (EUR–12412-EN) **Production of hydrogen for the hydrogenation of heavy oil and coal.** VEBA-Oel AG, Gelsenkirchen (Germany, F.R.). 1989. 63p. Source: Commission of the European Communities, Luxembourg.

The objectives of the overall project were the planning, construction and industrial testing of a commercial-sized plant for the entrained-flow gasification of solid fuels under high pressure. This project served to examine the technical feasibility, the possibilities for official approval and the economic viability of the demonstration plant before the final decision on its construction was taken.

52637 (EUR–12590-EN) **New hydrogen donors for direct liquefaction of coal.** Giuffre, L.; Tempesti, E.; Zanderighi, L.; Modica, G.; Girelli, A.; Galtieri, A.; Casalina, A.; Vecchi, C. Politecnico Milano (Italy). Dipt. di Chimica Industriale. 1990. 80p. Source: Commission of the European Communities, Luxembourg.

The use of tetralin and similar H-donor solvents in the hydroconversion of coal to liquid fuels is important in large scale coal conversion processes. The present study was undertaken with a new H-donor model compound (4-heptanol) to develop a better understanding of the role of hydrotreating catalysts (Co, Ni, Mo) in promoting the hydrogenation and cracking of aromatic and hydroaromatic compounds. A series of coal hydroliquefaction experiments was carried out in a 1 L stirred autoclave using UK (Point of Ayr) coal. The influence of operating conditions on liquefaction yields was explored in order to identify possible correlations with the activities and characteristics of the catalysts used.

52638 (EUR–12647-DE) **Coking pressure and coal moisture - effects during carbonization - implications for a new coking reactor design.** Habermehl, D.; Kolitz, V.; Rohde, W.; Szurman, E. Bergbau-Forschung GmbH - Forschungsinstitut des Steinkohlenbergbauvereins, Essen (Germany, F.R.). 1990. 89p. (In German). Source: Commission of the European Communities, Luxembourg.

The shutdown of the coke ovens at the Prosper coke plant of Ruhrkohle AG in Bottrop, offered a unique opportunity to determine the loading limit of intact heating walls when swelling-prone coals are employed. The shock-cooling of coke oven charges of various blend composition after partial carbonization was also studied. The third component of the research programme consisted of tests for determining the internal gas pressure using swelling-prone coals in the semi-technical coking ovens.

52639 (NSRFC–33125) **Studies on asphaltene conversion and catalyst regeneration in two-stage liquefaction of Nova Scotia fuels.** DSS File no. 006SQ.23440-8-9011. Starzomski, J.J.; Jay, D.M. Nova Scotia Research Foundation Corporation, Dartmouth, NS (Canada). Jan 1990. 88p. Source: CANMET, Technical Information Service, 562 Booth St., Room 20C, Ottawa, ON, Canada K1A 0G1.

Studies on asphaltene conversion and catalyst regeneration in two-stage liquefaction of coals were conducted. The project consisted of three main components: screening tests were conducted in a batch reactor system to evaluate the capacity of several hydro-processing catalysts to convert coal-derived asphaltenes into oil; laboratory experiments were carried out to determine the degree to which the activity of aged coal liquefaction catalyst can be restored via controlled oxidation; and finally, a series of two stage thermal/catalytic bench runs were conducted using Shell 317

nickel-molybdenum bimodal catalysts. Promising results were achieved in the catalyst regeneration study indicating a need for further research. It was determined that the use of a more active catalyst, with a larger service life, could greatly enhance the coal liquefaction process. 14 refs., 18 tabs., 10 figs.

52640 (NZERDC-P–120) **Identification of organic chemical components of lignites and lignite combustion products.** Grimmett, M.R.; Vickers, M. New Zealand Energy Research and Development Committee, Auckland (New Zealand). Aug 1987. 54p. Source: Ministry of Commerce, Energy and Resources Division, P.O. Box 2337, Wellington, New Zealand.

This describes the development of a method, sequential elution by selected solvent chromatography (SESC), to examine the general chemical composition of coal liquids. The materials obtained from I.P.D. included flash pyrolysis tars of various New Zealand coals and peats, and liquids obtained from the batch hydrotreatment of Roxburgh lignite pyrolysis tar. Upgraded liquids from the continuous hydrotreating of the same tar were examined also. Many methods exist for analysing crude oils e.g. high pressure liquid chromatography (HPLC). As coal liquids are quite different from crude oils it is unlikely that the methods used for studying crude oils will be directly comparable. The authors think complete analysis by gas chromatography - mass spectrometry would be of little practical utility given the vast numbers of compounds present in either crude oil or coal liquids. SESC allows separation of such products into general compound type but in a more specific manner than HPLC. This method, originally developed in a Mobil Oil laboratory, has been refined and the questions of mass balances and reproducibility addressed and found satisfactory. It was used to examine samples. The pyrolysis tars were shown to be very different from crude oils, as expected. Those from different coals exhibited marked differences in percentages of compound type, with the Roxburgh tar appearing to have the most promise. Hydrogenation of the pyrolysis tars gave products with compositions much more similar to crude oils than the raw tars, particularly when hydrogenated by a continuous flow method. The SESC method could detect no change in compound type for a tar that had aged for nearly a year, although other properties are known to change. The results were compared with those obtained for the same samples using HPLC. Results from HPLC may seriously over-estimate the amount of polar material in a sample. 9 refs., 16 tabs., 7 figs.

52641 (ORNL/FMP–90/1) **Proceedings of the fourth annual conference on fossil energy materials.** Judkins, R.R.; Braski, D.N. (comps.). Oak Ridge National Lab., TN (USA). Aug 1990. 514p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC05-84OR21400. (CONF-900546–: 4. conference on fossil energy materials, Oak Ridge, TN (USA), 15-17 May 1990). Order Number DE91001158. Source: NTIS, PC A21/MF A01 - OSTI; GPO Dep.

The Fourth Annual Conference on Fossil Energy Materials was held in Oak Ridge, Tennessee, on may 15–17, 1990. The meeting was sponsored by the US Department of Energy's Office of Fossil Energy through the Advanced Research and Technology Development (AR&TD) Materials Program, and ASM International. The objective of the AR&TD Materials Program is to conduct research and development on materials for longer-term fossil energy applications as well as for generic needs of various fossil fuel technologies. The work is divided into the following categories: (1) Ceramics, (2) New Alloys, (3) Corrosion and Erosion, and (4) Technology Assessment and Technology Transfer. Individual projects are processed separately for the data bases.

52642 (ORNL/TM–11039) **Characterization and control of the fiber-matrix interface in ceramic matrix composites.** Lowden, R.A. Oak Ridge National Lab., TN (USA). Mar 1989. 199p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC05-84OR21400. Order Number DE91000922. Source: NTIS, PC A10/MF A01 - OSTI; GPO Dep.

Fiber-reinforced SiC composites fabricated by thermal-gradient forced-flow chemical-vapor infiltration (FCVI) have exhibited both composite (toughened) and brittle behavior during mechanical property evaluation. Detailed analysis of the fiber-matrix interface revealed that a silica layer on the surface of Nicalon Si-C-O fibers tightly bonds the fiber to the matrix. The strongly bonded fiber and matrix, combined with the reduction in the strength of the fibers that occurs during processing, resulted in the observed brittle behavior. The mechanical behavior of Nicalon/SiC composites has been improved by applying thin coatings (silicon carbide, boron, boron nitride, molybdenum, carbon) to the fibers, prior to densification, to control the interfacial bond. Varying degrees of bonding have been achieved with different coating materials and film thicknesses. Fiber-matrix bond strengths have been quantitatively evaluated using an indentation method and a simple tensile test. The effects of bonding and friction on the mechanical behavior of this composite system have been investigated. 167 refs., 59 figs., 18 tabs.

52643 (ORNL/TM–11465) **Fabrication and mechanical properties of Fe_3Al-based iron aluminides.** Sikka, V.K.; McKamey, C.G.; Howell, C.R.; Baldwin, R.H. Oak Ridge National Lab., TN (USA). Mar 1990. 69p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC05-84OR21400. Order Number DE91001001. Source: NTIS, PC A05/MF A01 - OSTI; GPO Dep.

Iron aluminides based on Fe_3Al are ordered intermetallic alloys that offer good oxidation resistance, excellent sulfidation resistance, and lower material cost than many stainless steels. These materials also conserve strategic elements such as chromium and have a lower density than stainless steels. However, limited ductility at ambient temperature and a sharp drop in strength have been major deterrents to their acceptance for structural applications. This report presents results on iron aluminides with room-temperature elongations of 15 to 20%. Ductility values were improved by a combination of thermomechanical processing and heat-treatment control. This method of ductility improvement has been demonstrated for a range of compositions. Melting, casting, and processing of 7-kg (15-lb) heats produced at the Oak Ridge National Laboratory (ORNL) and 70-kg (150-lb) commercial heats are described. Vacuum melting and other refining processes such as electroslag remelting are recommended for commercial heats. The Fe_3Al-based iron aluminides are hot workable by forging or extruding at temperatures in the range of 850 to 1100°C. rolling at 800°C is recommended with a final 50% reduction at 650°C. Tensile and creep properties of 7- and 70-kg (15- and 150-lb) heats are presented. The presence of impurities such as manganese an silicon played an important role in reducing the ductility of commercially melted heats. 7 refs., 60 figs., 12 tabs.

52644 (VTT-SYMP–107, pp. 275-334) **Recent developments in gasification of low-grade fuels.** Patel, J.G. (Institute of Gas Technology, Chicago, Illinois (USA)); Mensinger, M.C. Valtion Teknillinen Tutkimuskeskus, Espoo (Finland). 1989. (CONF-890668–Vol.1: Symposium on low-grade fuels, Helsinki (Finland), 12-16 Jun 1989). In *Low-grade fuels: Volume 1.* 376p. Order Number DE91707607. Source: NTIS (US Sales Only), PC A17/MF A01.

The decade of the 1980s has been a disappointing one for the synthetic fuels industry. however, from the immense efforts expended in developing various technologies, gasification has been the most successful. Several demonstration and commercial projects have been technically successful and a few even continue to operate economically. Two areas of promising near-term potential for gasification are generation of electric power by integrated gasification combined cycle (IGCC) and production of high-value chemicals. In the USA, the Department of Energy's Clean Coal Technology Program is moving forward and should demonstrate a few of the newer coal gasification processes. In Europe, the fallout from Chernobyl is encouraging serious consideration of coal-based IGCC power plants and in Japan, groundwork is being laid by continuing research and development to improve several technologies. This paper examines the latest status of some of the larger projects in gasification of coal and low-grade fuels.

52645 (VTT-SYMP–107, pp. 361-372) **Experiences in the operation of the HTW process at the peat ammonia plant of Kemira Oy.** Koljonen, J. (Kemira Oy, Oulu (Finland). Oulu Works); Kurkela, E. Valtion Teknillinen Tutkimuskeskus, Espoo (Finland). 1989. (CONF-890668–Vol.1: Symposium on low-grade fuels, Helsinki (Finland), 12-16 Jun 1989). In *Low-grade fuels: Volume 1.* 376p. Order Number DE91707607. Source: NTIS (US Sales Only), PC A17/MF A01.

Kemira Oy has built an ammonia plant based on peat. The costs of the project amounted to FIM 230 million. The production was started in autumn 1988. The existing oil-based ammonia plant was

modified to use also peat gas in production. Peat gasification has been in produtional use with a partial capacity for thousands of hours together with oil gasification. The problems encountered have been due to the heterogeneous quality of peat, the inadequate capacity of peat crushing and the quality of crused peat. Difficulties have also been caused by the high naphthalene content of gas and by blockages in the heat cyclone recycle pipe of the gasification. Technical solutions for these problems are available, which proves that synthesis gas and ammonia production from peat in commercial scale is technically possible. The decision to build the peat ammonia plant was preceded by pilot-scale gasification experiments with the more advanced coal and biomass gasification processes: HTW (West Germany), MINO (Sweden) and U-GAS (USA), which all operate in the fluidized-bed principle. The HTW process was selected. The pretreatment and drying of peat were also studied experimentally. The peat is dried in the MoDo back-pressure steam dryer. The project is considered to be of great significance, because peat is the only indigenous raw material for synthesis gas available in Finland. The economic conditions in Oulu can be regarded reasonable due to local factors, such as established peat production, partial use of the existing ammonia plant, by-products based on synthesis gas, local need of ammonia for fertilizer production and the existing factory area and personnel.

52646 (VTT-SYMP–107, pp. 347-359) **State of development of the HTW process regarding its suitability for combined-cycle power stations.** Theis, K.A. (Rheinische Braunkohlenwerke AG, Cologne (Germany, F.R.)); Lambertz, J. Valtion Teknillinen Tutkimuskeskus, Espoo (Finland). 1989. (CONF-890668–Vol.1: Symposium on low-grade fuels, Helsinki (Finland), 12-16 Jun 1989). In *Low-grade fuels: Volume 1.* 376p. Order Number DE91707607. Source: NTIS (US Sales Only), PC A17/MF A01.

The Rheinische Braunkohlenwerke AG has been developing the High-Temperature Winkler (HTW) process for the gasification of coals and biomasses in a fluidezed bed under pressure. The process was tested in a PDU and a pilot plant. A demonstration plant with a throughput of 700 tonnes of dry brown coal per day for the production of synthesis gas started operation in early 1986. The HTW process is also particularly suited for use in combined-cycle power plants.

52647 (VTT-SYMP–107, pp. 335-346) **Combined-cycle power generation from coal, peat and biomass using the high-temperature Winkler (HTW) technology.** Keller, J. (Uhde GmbH, Dortmund (Germany, F.R.)); Meis, R. Valtion Teknillinen Tutkimuskeskus, Espoo (Finland). 1989. (CONF-890668–Vol.1: Symposium on low-grade fuels, Helsinki (Finland), 12-16 Jun 1989). In *Low-grade fuels: Volume 1.* 376p. Order Number DE91707607. Source: NTIS (US Sales Only), PC A17/MF A01.

The production of electric power applying the combined-cycle principle with integrated gasification step offers decisive advantages in comparison to the classic concept. The efficiency is increased considerably resulting in lower electricity production costs. The emissions (SO_2, NO_x, Dust) can be reduced to levels, which are far below the statutory limits. The High-Temperature Winkler (HTW) process has been developed to industrial maturity by Rheinbraun with Uhde acting as the engineering partner. The efficiency of the process has been proven by the operation of commercial-scale gasification plants for the generation of synthesis gas from lignite and peat. In view of its specific characteristics, the HTW process is also particularly suited for the generation of fuel gas. The technical features such as great variety off appropriate feedstocks, high flexifility, low consumption figures, favourable load change characteristics, availability of a proven waste heat recovery system, possibility to use air as an oxidant make the HTW process very attractive for the integration into a combined-cycle power plant. The technical concept of a combined-cycle power station of commercial size based on the HTW technology is described, potential future improvements are discussed. Various modifications are possible to adapt the concept to particular feedstocks or to special design conditions of the individual case. The advantages of the HTW-based combined-cycle power station are quantified by stating figures for expected efficiency and emission levels.

52648 **Thermoanalysis mechanisms. Evidence for an alternative pathway for radical migration in diffusionally constrained environments.** Buchanan, A.C. III (Oak Ridge National Laboratory, Oak Ridge, TN (USA). Chemistry Division); Britt, P.F.; Biggs, C.A. *Energy and Fuels (USA).* 4(4): 415-417 (Jul-Aug 1990).

Short communication. PYROLYSIS/chemical reaction kinetics; PYROLYSIS/hydrogen transfer; COAL/pyrolysis; PYROLYSIS; RADICALS; MIGRATION; DIFFUSION; SILICA; COAL; SURFACES; AROMATICS

52649 **Method and apparatus for in-situ biological conversion of coal to methane.** Volkwein, J. To Bureau of Mines, Washington, DC. USA Patent Application 7-540,598. 20 Jun 1990. 18p. Source: NTISPC N03/MF A01.

This Government-owned invention available for U.S. licensing and, possibly, for foreign licensing. Copy of application available NTIS.

The invention relates in general to a method for biologically converting coal to methane, and in particular to a method and apparatus for culturing in situ on a coal-containing substrate a consortium of microorganisms capable of degrading coal into methane under suitable anaerobic conditions.

0105 Products and By-Products

Refer also to citation(s) 52638, 52645

52650 (AD-A–224576/9/XAB) **Production of jet fuels from coal-derived liquids. Volume 13. Evaluation of storage and thermal stability of jet fuels derived from coal liquids. Interim report, August 1988-December 1989.** Sturm, G.P.; Grigsby, R.D.; Goetzinger, J.W.; Green, J.B.; Anderson, R.P. National Inst. for Petroleum and Energy Research, Bartlesville, OK (USA). May 1990. 69p. Contracts DE-FC22-83FE60149, MIPR-FY1455-86-N0657. Source: NTIS, PC A04/MF A01.

In September 1986, the Fuels Branch of the Aero Propulsion Laboratory of WPAFB, OH, began an investigation of the potential of the production of jet fuel from the liquid by-products streams produced by the gasification of lignite at the Great Plains Gasification Plant (GPGP) in Beulah, North Dakota. Funding was provided to the Department of Energy, Pittsburgh Energy Technology Center, to administer the experimental portion of this effort. This report details the program with the National Institute for Petroleum and Energy Research of the IIT Research Institute to study the storage and thermal stability of a JP-8 fuel produced from the GPGP liquid by-products streams. Sediments and deposits from stability tests were analyzed by IR and probe microdistillation/high resolution mass spectroscopy. Results were compared with corresponding results from a conventional petroleum-derived JP-8 fuel.

0106 Properties and Composition

Refer also to citation(s) 52633, 52640, 52650, 52675, 52703, 52706, 52707, 52708, 52709, 52710, 52711, 52764, 52959

52651 (DOE/MC/23284–2871) **A mechanistic study of the energetic heterogeneity of coal chars: Final report.** Calo, J.M.; Hall, P.J.; Lilly, W.D. Brown Univ., Providence, RI (USA). Div. of Engineering. Nov 1989. 213p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC21-87MC23284. Order Number DE90009681. Source: NTIS, PC A11/MF A01 - OSTI; GPO Dep.

The correlation and prediction of kinetic rates and mechanisms of the reactions of gas phase species with coal chars represent a difficult undertaking under the best of circumstances. Solid phase heterogeneity and impurities, complex pore structure, transport limitations, evolution of active surface, represent just a few of the well known problems and pitfalls. Calo and Perkins (1987) have shown that energetic heterogeneity of carbon surfaces can significantly enhance gasification reactivity in comparison to a benchmark homogeneous surface. This interesting result naturally gives rise to questions regarding whether chars can be upgraded or "engineered" to exhibit favorable surface heterogeneity with respect to significantly increasing reactivity for subsequent conversion and utilization processes. This work was directed at investigating these

factors. This information is needed in order to assess the potential of exploiting induced and/or natural coal char surface heterogeneity for the purpose of optimizing char reactivity. In addition, as will be shown, this approach shows considerable promise for providing a more global framework for correlation and true a priori prediction of char reactivity. 74 refs., 106 figs.

52652 (DOE/PC/88925–T2) **Correlation of stability/rheology relationship with coal properties and chemical additives: Quarterly progress report, March 15, 1990–June 15, 1990.** Ohene, F. Grambling State Univ., LA (USA). Dept. of Chemistry. [1990]. 3p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FG22-88PC88925. Order Number DE91000696. Source: NTIS, PC A01/MF A01 - OSTI; GPO Dep.

The overall objective of this project is to perform experiments to evaluate the necessary boundary conditions in the preparation and utilization of Coal Water Slurries (CWS) and also develop a data base for the conceptual analysis of a prescription to predict slurry quality for a given coal candidate. This quarter, zeta potential and static stability measurements of three coal slurries have been made using poly naphthalene ammonium sulphonate, A-23, A-23S MCG-32A-LS and Igepal 990 as dispersants and at a pH of 10. A preliminary study of the static stability measurements were made in a column having two outlet ports separated by a distance of 1 ft. Samples were withdrawn periodically from these ports and the solid content profile was determined for an initial period of one week. Based on the results obtained from this preliminary study, larger samples were prepared and the stability measurements made in a 6 ft column having three outlet ports with a water jacket surrounding it. Zeta Potential measurements were made prior to the stability studies. 1 tab.

52653 (DOE/PETC/TR–90/8) **On the viscosity of a mixture of particulate solids and a fluid continuum.** Massoudi, M. (USDOE Pittsburgh Energy Technology Center, PA (USA)); Ekmann, J.M.; Rajagopal, K.R. USDOE Pittsburgh Energy Technology Center, PA (USA). Sep 1990. 46p. Sponsored by U.S. DOE Fossil Energy. Order Number DE91000940. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

In this work, the theory of interacting continua is used to formulate the governing equations of motion for each component and the mixture (a granular material and Newtonian fluid) as a whole. The fluid is assumed to be an incompressible viscous fluid and solid particles are treated as granular materials. Appropriate constitutive relations for stresses are proposed. Based on these, the stress tensor for the mixture is obtained, and in some ideal experiment where the velocities of the two phases are equal, a relationship among the viscosities of the two components and the viscosity of mixture exists. Based on these observations, simple experiments can be devised to obtain the viscosity of the solid particles. In Section 1, the importance of multicomponent flows is discussed. Section 2 provides a survey of literature on the stress tensors in two-phase flows. In Section 3, the basics of the theory of interacting continua are discussed and equations of motion for the mixture are derived. In the final section, a few experiments are suggested that would help in measuring the material properties of the mixture. 73 refs.

52654 (IS–4999) **Functional group analysis in coal by ^{31}P NMR spectroscopy: Quarterly report, January 1, 1989–March 31, 1989.** Vorkade, J.G. Ames Lab., IA (USA). May 1989. 7p. Sponsored by U.S. DOE Fossil Energy. DOE Contract W-7405-ENG-82. Order Number DE91001299. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The purpose of this research is to determine the labile-hydrogen functional group composition of coal and coal-derived materials by the nmr spectroscopy of their derivatives made with reagents containing the nmr-active nuclei ^{31}P, ^{119}Sn, or ^{205}Tl. 7 refs.

52655 (NEI-FI–123) **Changes in steam coal during storage.** Nieminen, M.; Moilanen, A. Secretaria de Asentamientos Humanos y Obras Publicas, Mexico City (Mexico). 1989. 24p. (In Finnish). Project KTM-335/881/84. Order Number DE91707432. Source: NTIS (US Sales Only), PC A03/MF A01.

Changes in steam coal during storage were studied under laboratory conditions. The samples were aged under conditions equal to storage in practice. Samples were taken from the coals during laboratory weathering and proximate and ultimate analyses were carried out for them. In addition, changes in coal structure were monitored by microscopy using petrographic methods. Changes in coal mass during the weathering test were also studied. The aim of the study was to evaluate the significance of changes in coal during storage with regard to the use of steam coal and to study possible differences in storage resistance between different steam coal grades. In the laboratory weathering tests nine steam coal samples were aged for 98-110 days. The samples were produced from larges coal lamps by crushing and sieving certain particle size fractions from the crush. The samples were aged under thermostated conditions in vertical tubes by blowing air through the samples at a flow rate equal to storage in practice. Moisture was added at times to air. 5-8 samples of about 15g were taken from each coal sample during the tests. Moisture, ash, and volatile contents, heat value and elemental analysis (C, H and N) were determined for the samples. Typical signs of weathering (fissure formation) developed in the structure of the samples were monitored by microscopy. Signs of changes were monitored in the above characteristics of the aged samples. The mass of the samples seemed to increase during ageing (probably due to oxygen adsorption). Changes in other characteristics are explained by the increase in mass. In the microscopical study signs of weathering were found also in original coal samples. However, all the monitored changes in the characteristics of steam coal samples during ageing test were fairly small.

52656 **Microscopic NMR imaging of coal.** Dieckman, S.L. (Argonne National Laboratory, Argonne, IL (USA). Materials and Components Technology Division and Chemistry Division); Gopalsami, N.; Botto, R.E. *Energy and Fuels (USA)*, 4(4): 417-418 (Jul-Aug 1990).

Short communication. BITUMINOUS COAL/nmr spectra; NMR SPECTRA/image processing; LITHOTYPES/images; MICROSCOPY; HYDROGEN 1; LITHOTYPES; IMAGES; MACERALS; PULSE TECHNIQUES

0108 Waste Management

Refer also to citation(s) 52704, 52954, 52957, 52958, 53166, 53763

52657 (DOE/MC/25042–2872) **Waste disposal/utilization study: Final report.** Baker/TSA, Inc., Coraopolis, PA (USA). Jun 1990. 336p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC21-88MC25042. Order Number DE90009694. Source: NTIS, PC A16/MF A01 - OSTI; GPO Dep.

The "Waste Disposal/Utilization Study" was performed to assess potential alternatives for disposal and utilization of solid wastes produced from the following advanced coal combustion/conversion processes: coal gasification; fluidized bed combustion; limestone furnace injection; advanced (dry) flue gas desulfurization systems; advanced coal cleaning. Since systems should be integrated for effective waste management, the investigation also included assessment of waste handling (transfer, storage, preconditioning, and transport) system alternatives which would interface with final waste disposal and/or utilization systems. Study results are based primarily on waste management information from both conventional and advanced coal combustion/conversion facilities obtained from literature sources. When possible and appropriate, literature information was updated and supplemented by telephone communications. 277 refs., 5 figs., 78 tabs.

52658 (EUR–12317-ES) **The treatment and use of waste resulting from the washing of black lignite in Andorra.** Endesa, Madrid (Spain). 1990. 84p. (In Spanish). Source: Commission of the European Communities, Luxembourg.

The project is separated into two parts, the first of which is devoted to the study of the use of non-pyritic waste by its combustion in fluidized beds; the second part concerns the processing of pyritic waste, mainly in order to obtain sulphur and minor elements.

52659 (EUR–12649-EN) **Improving fine particle removal from flue gases in coal-fired processes.** British Coal Corp., Stoke Orchard (UK). Coal Research Establishment. 1990. 153p. Source: Commission of the European Communities, Luxembourg.

Studies have been conducted on specially constructed fabric filter, multicyclone and electrostatic precipitator test rigs, and other

established test facilities, to improve the design and operation of these particulate control technologies. Two conclusions have been drawn. Firstly, there is considerable scope for improving the performance and reducing the costs of fabric filtration. Three of the more important options identified are: (a) introducing the dirty flue gas into the top of the filter housing rather than the bottom, (b) using a new heavyweight glass fibre fabric for increased durability at acceptable cost, and (c) the use of a new proprietary polymeric fabric finish to increase overall filter performance. Secondly, improvements in the design of cyclone systems should increase the prospects of compliance with the new EC grit emission limit of 100 mg/m^3, when the improved cyclones are fitted to chain and travelling grate stokers. Improvements identified include: (a) the use of two cell modifier devices to increase grit collection efficiency and reduce pressure drop, (b) the development of an intercell baffle arrangement to increase collection efficiency and (c) the need to design carefully the geometry of the entry and exit ductwork either side of the multicyclone for maximum equipment performance. Further work is required before a mathematical model can be developed to predict optimum design and performance of electrostatic precipitators. Studies on the test rig at CRE have confirmed the importance of coal sulphur content on particle collection by the precipitator. In addition, it has been shown that high combustion efficiency, which produces low carbon fly ash, is necessary for more effective precipitator performance.

52660 (NRC-C–1147-885) **Waste fine coal recovery project (1987) at the Elkview preparation plant of Westar Mining Ltd.** Hazlett, J.; Bennett, A.; Coleman, R.; Croteau, S.; McCracken, T.; Toll, F. National Research Council of Canada, Ottawa, ON (Canada). Div. of Chemistry. Feb 1988. 22p. Source: National Research Council of Canada, Ottawa, ON (Canada). Div. of Chemistry.

Canada/British Columbia Mineral Development Subsidiary Agreement.

A pilot-scale demonstration project was carried out at the Elkview Preparation Plant of Westar Mining Ltd., near Sparwood, British Columbia. Using the National Research Council's mobile agglomeration facility, the potential recovery of coal fines (previously being wasted to tailings lagoons) was examined. The objective of this study was to determine if a consistent agglomerated product could be produced for use as a cement kiln fuel - this objective was achieved. Also, data was collected as to the performance characteristics of various pieces of process equipment.

52661 (PB–90-262916/XAB) **Pilot evaluation of enhanced E-SOx process.** Chang, J.C.S.; Hovis, L.S. Acurex Corp., Research Triangle Park, NC (USA). 1990. 24p. Contract EPA-68-02-4701. Source: NTIS, PC A03/MF A01.

The paper discusses pilot-plant tests with a 28 cu m/min (1000 cfm) electrostatic precipitator (ESP) to evaluate techniques that have a potential for enhancing the SO_2 removal of the E-SOx process for retrofit application. The techniques investigated included mass-transfer additives, improved gas/liquid contact, product recycle, and recycle activation through a combination of hydrating, heating, and mixing. Marginal effects were obtained with the mass-transfer additives tested. Improving the gas-flow pattern and gas/liquid contact had a positive influence on SO_2 removal and demonstrated the importance of flow control and spraying system design. Significant SO_2 removal enhancement was obtained with recycle operation. When the recycle material was further activated, SO_2 removal of 60-65% was achieved at a lime stoichiometry of 1.2.

52662 (PB–90-266644/XAB) **Remote sensing of mine waste. Information Circular/1987.** Boldt, C.M.K.; Scheibner, B.J. Bureau of Mines, Washington, DC (USA). 1987. 49p. (BUMINES-IC–9152). Source: NTIS, PC A03/MF A01.

Also available from Supt. of Docs. Library of Congress catalog card No. 86-600407.

The report summarizes five separate Bureau of Mines contract studies on the use of aerial photogrammetry, satellite transmission of in situ instrumentation information, and satellite imagery to monitor and update mine waste embankment data. The equipment used, methods applied, results, recommendations, and cost analyses are presented along with a bibliography of related investigations.

52663 (PB–90-266701/XAB) **Mine drainage and surface-mine reclamation. Volume 1. Mine water and mine waste. Information Circular/1988.** Bureau of Mines, Washington, DC (USA). 1988. 423p. (BUMINES-IC–9183). Source: NTIS, PC A18/MF A03.

Mine waste and mine reclamation are topics of major interest to the mining industry, the government and the general public. There were nine sessions (50 papers) that dealt with the geochemistry, hydrology and problems of mine waste and mine water, especially acid mine drainage. These comprise Volume 1.

52664 (UBA-FB–90-009/3) **Testing and completion of a recording scheme for soil contaminations typical of various industrial sectors in abandoned sites in the Ruhr mining district. Abandoned-site file for the Wohlverwahrt colliery, Essen.** Umweltbundesamt, Berlin (Germany, F.R.); Technischer Ueberwachungs-Verein Rheinland e.V. (TUeV), Koeln (Germany, F.R.). Inst. fuer Energietechnik und Umweltschutz; Dortmund Univ. (Germany, F.R.). Inst. fuer Umweltschutz; Ecosystem GmbH, Duesseldorf (Germany, F.R.); Kommunalverband Ruhrgebiet, Essen (Germany, F.R.); Ministerium fuer Umwelt, Raumordnung und Landwirtschaft des Landes Nordrhein-Westfalen, Duesseldorf (Germany, F.R.). 1990. 63p. (In German). Contract UFOPLAN-Nr. 1090203402. Source: Copy held by UB/TIB Hannover. .

Historical analysis reveals, especially, coal briquetting to be a potential source of soil contamination with polycyclic aromatic hydrocarbons in the black-coaltar pitch used as a principal pollution component, flotation agents, heavy metals, and traces of polycyclic biphenyls. (EF).

52665 (UBA-FB–90-009/6) **Testing and completion of a recording scheme for soil contaminations typical of various industrial sectors in abandoned sites in the Ruhr mining district. Abandoned-site file for the Gelsenkirchen coal distillation plant.** Umweltbundesamt, Berlin (Germany, F.R.); Technischer Ueberwachungs-Verein Rheinland e.V. (TUeV), Koeln (Germany, F.R.). Inst. fuer Energietechnik und Umweltschutz; Dortmund Univ. (Germany, F.R.). Inst. fuer Umweltschutz; Ecosystem GmbH, Duesseldorf (Germany, F.R.); Kommunalverband Ruhrgebiet, Essen (Germany, F.R.); Ministerium fuer Umwelt, Raumordnung und Landwirtschaft des Landes Nordrhein-Westfalen, Duesseldorf (Germany, F.R.). 1990. 68p. (In German). Contract UFOPLAN-Nr. 1090203402. Source: Copy held by UB/TIB Hannover.

The report covers the history of use of the site, its geology and hydrogeology. Conclusions to possible soil contaminations are drawn from the production processes or operations. The contamination potential of the area is determined by the coking plant with its various plants yielding by-products. Soil contamination with polycyclic aromatic hydrocarbons and benzene/toluene/xylene is to be suspected. (EF).

52666 (UBA-FB–90-009/7) **Testing and completion of a recording scheme for soil contaminations typical of various industrial sectors in abandoned sites in the Ruhr mining district. Abandoned-site file for the Herne gas works.** Umweltbundesamt, Berlin (Germany, F.R.); Technischer Ueberwachungs-Verein Rheinland e.V. (TUeV), Koeln (Germany, F.R.). Inst. fuer Energietechnik und Umweltschutz; Dortmund Univ. (Germany, F.R.). Inst. fuer Umweltschutz; Ecosystem GmbH, Duesseldorf (Germany, F.R.); Kommunalverband Ruhrgebiet, Essen (Germany, F.R.); Ministerium fuer Umwelt, Raumordnung und Landwirtschaft des Landes Nordrhein-Westfalen, Duesseldorf (Germany, F.R.). 1990. 71p. (In German). Contract UFOPLAN-Nr. 10902034/02. Source: Copy held by UB/TIB Hannover.

The report contains comprehensive information on construction files, gas storage and distribution plants, and other plants operated by the town works of Herne. The soil contamination potential is predominantly determined by the gas works. Although it was operated a long time ago, pollutants must still be expected to be present in the soil. This holds good in particular of polycyclic aromatic hydrocarbons and cyanides. But benzene, toluene, and xylene cannot be expected to have been completely degraded either. (EF).

52667 (UBA-FB–90-009/15) **Testing and completion of a recording scheme for soil contaminations typical of various industrial sectors in abandoned sites in the Ruhr mining district.**

Abandoned-site file for the coal-fired power plant Springorum, Bochum. Umweltbundesamt, Berlin (Germany, F.R.); Technischer Ueberwachungs-Verein Rheinland e.V. (TUeV), Koeln (Germany, F.R.). Inst. fuer Energietechnik und Umweltschutz; Dortmund Univ. (Germany, F.R.). Inst. fuer Umweltschutz; Ecosystem GmbH, Duesseldorf (Germany, F.R.); Kommunalverband Ruhrgebiet, Essen (Germany, F.R.); Ministerium fuer Umwelt, Raumordnung und Landwirtschaft des Landes Nordrhein-Westfalen, Duesseldorf (Germany, F.R.). 1990. 78p. (In German). Contract UFOPLAN-Nr. 109020342. Source: Copy held by UB/TIB Hannover.

The report covers the history of use of the site, its geology and hydrogeology. From the evaluations it is clear that the Weitmar chemical factory was in operation a long time ago and that the coal-fired power station was tied up, yet soil sampling was considered indispensable. The soil must be screened for phenols, polycyclic aromatic hydrocarbons, benzene/toluene/xylene, polychlorinated biphenyls, and chlorinated hydrocarbons. (EF).

52668 (VTT-TIED–1131) **Desulphurization by sorbent injection: Construction and operation of an isothermal flow reactor.** Hepola, J. (Valtion Teknillinen Tutkimuskeskus, Espoo (Finland). Polttoainetekniikan laboratorio); Aeijaelae, M. Valtion Teknillinen Tutkimuskeskus, Espoo (Finland). May 1990. 36p. (In Finnish). Order Number DE91707458. Source: NTIS (US Sales Only), PC A03/MF A01.

Construction and operation of an isothermal flow reactor is presented. Fundamentals of injection desulphurization technology have been studied with the aid of this reactor at the Laboratory of Fuel and Process Technology of the Technical Research Centre of Finland over the years 1985-1989. Reaction temperature, residence time, and flue gas composition can be regulated independently of each other. The flue gas is formed by burning LPG. Other gases can be mixed with the flue gases to get the desired gas composition. The hot flue gas is led into a vertical reactor. To compensate heat losses the reactor tube is kept at the desired temperature with the aid of electric resistances installed around the tube. Flow in the reactor is laminar. Sorbent powder of 1-100 μm in particle size can be fed by a powder feeder at a rate of 0.2-5 g/min into the reactor. Reacted solid matter is collected with an axially movable, water-cooled and nitrogen-diluted sampling probe in the reactor tube. The residence time of solid matter in the reactor ranges 0.1-1 s, depending on the gas amount flowing in the reactor tube and on the position of the sampling probe in the tube. The sample is collected n a cyclone or a filter at the end of the probe. Calcium and sulphur compounds, specific surface area, and pore and particle size distributions are analyzed for the sample.

52669 (VTT-TUTK–680) **Hardening properties of desulphurization wastes.** Haekkinen, T. Valtion Teknillinen Tutkimuskeskus, Espoo (Finland). Apr 1990. 71p. (In Finnish). Order Number DE91707456. Source: NTIS (US Sales Only), PC A04/MF A01.

The hardening properties of desulphurization wastes from coal-fired power plants were studied. The properties under considerawere setting, strength development, permeability and microstructure. Laboratory tests were performed on different mixtures of products of the wet-dry method, fluidized-bed reactor and injection technique. Hardening of the waste products was activated with Portland cement and blast furnace slag. Also studied were the utilization alternatives for cement-bound gravel and roller-compacted concrete. The setting properties were found to be moderate or good. The products of the fluidized-bed reactor and injection technique might especially be suited to the manufacture of compacted stone and for the production of roller-compacted concrete.

0109 Environmental Aspects

Refer also to citation(s) 52629, 52663, 52717, 52960, 53101, 53668, 53785

52670 (CRIE-T–89025) **Development of an environmental assessment method for coal particle dispersion caused by coal-handling facilities.** Ichikawa, Y.; Asakura, K. Central Research Inst. of Electric Power Industry, Komae, Tokyo (Japan). Energy and Environment Lab. Mar 1990. 57p. (In Japanese). Order Number DE91715328. Source: NTIS (US Sales Only), PC A04/MF A01.

On the basis of wind tunnel experiment, site surveying and document surveying for power stations, the present predicting approach for coal particle dispersion was reviewed and improved predicting approach was proposed. All coal handling facilities open to the atmosphere were assumed as the coal dust generating places. Three kinds of coal for which the model was prepared from grain size distribution and specific gravity, were used. Dust generation could be classified as that from the coal pile surface, during coal dropping and during coal handling. The formula for dust generating intensity (time integrated dust emission rate) was implied on the basis of wind tunnel experiments and site experiments. The formula for dust generating intensity was prepared for each coal dust generating place on the basis of the above results and operating mode of each coal handling facility, countermeasures to prevent dust emmision, and each coal handling plan. These formulae could expand the applicable range to wider range of moisture and wind velocity than conventional ones and improved the reliability. Coal dust deposits by the new predicting approach for three months were calculated at three locations such as power stations and coal centers in which depositing coal dust was measured. Predicted values and measurements agreed well, indicating that this predicting approach can apply to the environmental assessment, 17 refs., 22 figs., 10 tabs.

52671 (PB–90-259045/XAB) **Environmental monitoring plan for the Dow Syngas Project. Quarterly report: First quarter, 1990. Report for 1 January-31 March 1990.** Rozas, T.J. Louisiana Gasification Technology, Inc., Plaquemine, LA (USA). 31 May 1990. 59p. Source: NTIS, PC A04/MF A01.

See also Annual rept. for 1989, PB–90-259037.

The Energy Security Act of 1980 established a program to provide financial assistance to private industry in the construction and operation of commercial-scale synthetic fuels plants. The Dow Syngas Project design is a high-temperature entrained-flow slagging type gasifier that began operating in 1987. Dow agreed to comply with existing environmental regulations and to develop an Environmental Monitoring Plan (EMP) incorporating supplemental monitoring areas of potential environmental and health concern, relative to synthetic fuels facilities. The phases of monitoring in the EMP will test parameters of interest in air, water and solid waste for evaluating plant operations and for establishing a data base of information for resolving environmental uncertainties relative to replication of synthetic fuels plants. Results of medical monitoring, permit changes and fugitive emission testing are presented. Activities associated with 1,311 samples and nearly 4,000 tests are summarized.

52672 (PB–90-260068/XAB) **Health assessment for Reilly Tar and Chemical Corporation, Dover, Ohio, Region 5. CERCLIS No. OHD980610042. Preliminary report.** Agency for Toxic Substances and Disease Registry, Atlanta, GA (USA). 18 Jul 1990. 15p. Source: NTIS, PC A03/MF A01.

See also PB–90-107426.

The Reilly Tar and Chemical Corporation site, Dover, Ohio, has been proposed for the National Priorities List by the U.S. Environmental Protection Agency. The site–a coking plant and foundry from approximately 1910 until the late 1920s and a coal tar refinery from 1932 until 1956–has been vacant since 1956. Operations and waste disposal practices have contaminated soil and ground water with polynuclear aromatic hydrocarbons (PAHs) and volatile organic compounds (VOCs). Based upon information reviewed, the Agency for Toxic Substances and Disease Registry has concluded that the site is of potential public health concern because of the risk to human health resulting from possible exposure to hazardous substances at concentrations that may result in adverse human health effects. As noted in the Human Exposure Pathways Section, human exposure to PAHs and VOCs may be occurring and may have occurred in the past via soil and ground water. Recommendations are provided concerning additional sampling and further restrictions to public access.

52673 (PB–90-264078/XAB) **Illinois land report, Salem Township of Knox County. Final report.** Illinois Dept. of Energy and Natural Resources, Springfield, IL (USA). Lands Unsuitable for

Mining Program. 24 Jun 1990. 696p. (IL/ENR/RE/GI–90/12). Source: NTIS, PC A99/MF A04.

The report was prepared by the Illinois Department of Energy and Natural Resources (ENR) for the Illinois Department of Mines and Minerals (DMM) under the authorization of the Illinois Surface Coal Mining Land Conservation and Reclamation Act (PA 81-1015). A petition to designate certain farmlands in Salem Township of Knox County, Illinois, unsuitable for mining was filed with DMM by local landowners and the Knox County Farm Bureau, Inc. ENR is required to prepare a land report for these petitions when they are declared complete by DMM. The land report documents the status of existing resources in the petition area and surrounding region and the impact a declaration of unsuitability would have on these resources in the future. Further, the report discusses the impact of mining on existing land use plans or programs, fragile or historic lands, renewable resource lands, the human environment, socioeconomic resources and natural hazard lands.

52674 (PB–90-267253/XAB) **Treatability of contaminated ground water and aquifer solids at town gas sites, using photolytic ozonation and chemical in-situ reclamation. Final report.** Peyton, G.R.; LeFaivre, M.H.; Smith, M.A. Illinois State Water Survey Div., Champaign, IL (USA). Aquatic Chemistry Section. Aug 1990. 61p. Source: NTIS, PC A04/MF A01.

The feasbility of cleaning up contaminated ground water and aquifer solids from so-called town gas sites using photolytic ozonation and chemical in situ aquifer reclamation (CISR) techniques was investigated in the laboratory. At the actual site, coal was thermally oxidized to produce methane for municipal distribution. The degradation left a coal tar which, if released into the ground, could contaminate ground water and aquifer solids with a number of organic substances, including aromatic hydrocarbons such as benzene, toluene, xylene (BTX), and polynuclear aromatic hydrocarbons (PAHs) at environmentally significant concentrations. A chemical in situ treatment method using persulfate as a source of free radicals destroyed organic contaminants that were adsorbed to the aquifer solids. PAHs were reduced by 34 percent after 12 days of treatment and by 52 percent after 40 days.

0110 Reserves, Geology, and Exploration

52675 (IEACR–13) **Lignite resources and characteristics.** Couch, G.R. IEA Coal Research, London (UK). ©Dec 1988. 102p. Sponsored by International Energy Agency. Source: IEA Coal Research, 14-15 Lower Grosvenor Place, London, SW1W 0EX, England.

This report contains a country by country assessment of both the resources and characteristics of lignites/brown coals. For each of the 27 countries covered, details of the resources, the main characteristics and the extraction rate and use are given where possible. The assessment highlights the variability in the material from deposit to deposit, and sometimes within a deposit. Such variability is a characteristic of lignite/brown coal and is particularly associated with the amount and composition of ash. Various inorganics present can and do cause problems for the user. They result in fouling and erosion in boilers, and other problems when lignite is used as a feedstock for upgrading or conversion processes. These problems are reviewed briefly. This report also addresses the interaction between mine planning and lignite/brown coal use, covering exploration, mining methods, stockyard engineering and analysis of lignite/brown coal. 109 refs., 59 figs., 39 tabs.

0120 Mining

Refer also to citation(s) 52725, 52726, 52728, 52729, 52730

52676 (ERP/CRL–89-87(TR)) **Tracer gas used for mine fire simulations.** Klinowski, G.W.; Kennedy, D.J. Canada Centre for Mineral and Energy Technology, Sydney, NS (Canada). Cape Breton Coal Research Lab. Nov 1989. 35p. Source: CANMET, Technical Information Services, 562 Booth St., Room 20C, Ottawa, ON, Canada K1A 0G1.

Tracer gas based techniques are often used in the examination of mine ventilation systems. Cape Breton Coal Research Laboratory staff have designed, built, tested and proved the necessary equipment and methodology for tracer gas based surveying techniques in mines. In this study, a fire was simulated to gain knowledge of smoke distribution patterns in the Orchard Valley Mine, Nova Scotia. Both the integrity of appointed escape routes, and the performance of equipment were asserted in this study. 1 ref., 12 tabs., 13 figs.

52677 (EUR–12084-EN) **Multiprocessor systems development.** British Coal Corp., Stanhope Bretby (UK). Headquarters Technical Dept. 1990. 200p. Source: Commission of the European Communities, Luxembourg.

This report describes the design aims and much of the detail required to implement a generalised control and monitoring system which could be applied to any particular mining equipment. To achieve these aims, a high degree of flexibility was required in the systems design. To ensure that single failures did not affect an entire colliery and to enable the control equipment to be physically close to the plant under control, the system was designed as a distributed network of control elements which could be remotely monitored. A part of the system design was implemented as a surface monitoring package and has been used successfully to monitor both shearers and in-seam miners.

52678 (EUR–12650-FR) **Study of climatic conditions in cooled and uncooled workplaces at great depth.** Instituut voor Reddingswezen, Hasselt (Belgium). 1990. 81p. (In French). Source: Commission of the European Communities, Luxembourg.

The objectives of the project were to improve underground working conditions, predict the climate in future workplaces, assess the desirable refrigeration requirements, and optimise the performances of the existing cooling installations. Computer programs were used for climate assessment and prediction. Data were acquired over a period of time, and the values of empirical parameters obtained by fitting the model for climatic prediction to the data measured at two different workplaces. Climate predictions were calculated to schedule the cooling powers reuqired to fulfill the climate standards in force.

52679 (EUR–12654-DE) **Development of external equipment for controlled advance of coal winning machines.** Brychta, P.; Plum, D. Bergbau-Forschung GmbH - Forschungsinstitut des Steinkohlenbergbauvereins, Essen (Germany, F.R.). 1990. 142p. (In German). Source: Commission of the European Communities, Luxembourg.

Slowly running winning machines such as coal ploughs equipped with activated cutting tools, require feed forces up to 300 kN for running speeds varying from 0 to 0.4 m/s, whereas shearer-loaders absorb feed forces up to 400 kN for running speeds between 0 and 0.1 m/s. Coal ploughs functioning on activated tools can no longer be operated as conventional ploughs with pole-reversible drives but rather have to adopt, just like shearer-loaders, feed control over the full speed range. A high motor torque is necessary during standstills in order to maintain the cutting tools in coal face contact. Given the restricted space available on the plough adjustable drives must be installed in the gateroads with the plough being drawn by channel-guided chains. In the case of shearer-loaders, elasticity-induced oscillations due to external feeds have to be eliminated. Theoretical studies on system behaviour were carried out by a complex computer simulation taking into account any and all masses, forces, rigidity of chains, and attenuations as well as varying loads, creepage, and blockages. Practical surface tests were also carried out.

52680 (EUR–12655-EN) **Research into the influence of the design of permanent support systems on gateroad stability under differing geological conditions and mining methods.** Smart, B.G.D.; Olden, P.W.H.; Lindsay, J.; Crawford, B.; Robertson, B.; Smith, W. British Coal Corp., Stanhope Bretby (UK). Headquarters Technical Dept. 1990. 155p. Source: Commission of the European Communities, Luxembourg.

Numerical and physical modelling techniques were developed and used to assist in the interpretation of underground observations of gateroad behaviour and the evaluation of proposed innovations in permanent support system construction, such as: the modification of monolithic pack performance, giving higher reaction to roof

lowering per unit volume of pack placed; the design of support systems for installation on (or through) soft floor which will enable adequate reactions to roof lowering to be developed and maintained; and the design of steel arches with increased yield strength when subjected to the asymmetrically distributed loads which occur in-situ. These proposed innovations were evaluated to field trial stage and a number of recommendations presented.

52681 (MRP/MRL-84-84(TR)) **A proposal for a major research project on rockbursts.** Udd, J.E. Canada Centre for Mineral and Energy Technology, Ottawa, ON (Canada). Mining Research Labs. Dec 1984. 24p. Source: Canada Centre for Mineral and Energy Technology, Ottawa, ON (Canada). Mineral Research Labs.

Rock bursts have the potential to do a lot of damage to a mining site, in both human and economic terms. This paper suggests a solution to the problem might be found through the use of microseismic systems to measure stress increases which precede rockburst activity. A proposal is presented which would involve investigation, development and testing of equipment and methodologies for measuring microseismic activity.

52682 (OY/PSTL-TIED-68) **Information of economical and employment effects of contractional peat production: An inquiry.** Kiukaanniemi, E.; Tervo, H. Oulu Univ. (Finland). Research Inst. of Northern Finland. Dec 1989. 25p. (In Finnish). Order Number DE91707434. Source: NTIS (US Sales Only), PC A03/MF A01.

The nature and especially the economical features of contractional peat production have been evaluated in this research based on an postal inquiry. Peat production is action of seasonal nature, the length of a production season being only about three months. The contractors are doing other contractional work, they are conditioning peat production fields and farming their own farms. Due to short production season it is difficult to earn enough money from contractional peat production, so other work outside the production season is important for economy of contractional peat production. Capital costs of machinery and labor costs form the main part of the costs in contractional peat production. Contraction fees to phasing contractors form considerable costs for total work contractor. Loan treatment costs of machinery loans form about 1/5 of the total costs. If the income financing in equipment acquisition is taken into account, portion was calculated to be 2/5 of the total costs. The contractors who answered the inquiry produced about 1.0 million m3 of peat (in stockpiles) during the summer 1988. The number of contractors and employee working for them was about 175 persons. Due to the shortness of the working period the contribution of work was about 36 person working years in total. The productivity per person working year was hence about 28 000 m3. Due to low prices of imported fuels the price obtained of peat has been low during the last years. The prices of machines and labor have however risen in accordance to universal increase of costs, which lowers the profitability of contractional peat production.

52683 (PB-90-259524/XAB) **Evaluation of rotating water seal for frictional ignition-spray system on a wet-head continuous miner. Open File Report, July 1984-February 1989 (Final).** Kost, J.A. BCR National Lab., Pittsburgh, PA (USA). Apr 1989. 54p. Contract J0395040. (L-1613). Source: NTIS, PC A04.

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The contract objective was to conduct an in-mine test of a rotary water seal and anti-frictional ignition spray system for a continuous mining machine. Previous research had shown that water sprays mounted on a longwall shearer drum reduced the likelihood of frictional ignitions. Past efforts to direct water to the drum of a continuous miner failed because a suitable rotary water seal was not available. In 1983, a seal developed by Cannings Seals Ltd. for use on road heading machines in British mines appeared to have high potential for successful application on continuous miners. A Lee-Norse 265 miner was retrofitted and put into service in May 1987. The machine, after mining in excess of 150,000 tons, was taken out of service in May 1988 without incurring any seal problems. This underground trial demonstrates that there is now a viable water seal for use on continuous miners to provide water to the cutting drum.

52684 (VTT-OPT-10) **Unoccupied peat production.** Hirvonen, P.; Aho, V.; Leinonen, A. Technical Research Centre of Finland, Jyvaeskylae (Finland). Combustion and Thermal Engineering Lab. May 1990. 20p. (In Finnish). Project KTM-275/881/87. Order Number DE91707440. Source: NTIS (US Sales Only), PC A03/MF A01.

OPTIMITURVE Research Program.

Methods needed for automation of milled peat production are reviewed in this report. The main targets of the research were the utilization possibilities of the tractors available on the Finnish vehicle markets, the suitabilities of different positioning methods and control technologies for unoccupied production. Some of the tractor models are suitable without any changes or with minor changes as targets for automation. A positioning system based on micro-wave technology seems to be a suitable starting point for development of the control system for an unmanned vehicle. A coarse estimation of development and investment costs of the system is included in this report.

52685 (VTT-OPT-12) **Power demand of peat miller and the factors effecting on granular size.** Uusi-Kauppila, T.; Leinonen, A. Technical Research Centre of Finland, Jyvaeskylae (Finland). Combustion and Thermal Engineering Lab. Jun 1990. 40p. (In Finnish). Project KTM-275/881/87. Order Number DE91707442. Source: NTIS (US Sales Only), PC A03/MF A01.

OPTIMITURVE Research Program.

The aim of this research was to study the principles of milling of peat, to obtain larger granular size (15-20 mm) than at present and the optimal energy consumption. The research was carried using miller simulator tests, the results of which gave information of the factors effection on granular size of peat and power demand. The testing was done using worm, pin drum, knife, and upsetting shredding flat cutters. The results of the research showed that increasing of milling depth also increases the granular size with all o the tested miller types. The increasing of the rotational speed decreased the granular size, due to diminished feed, and the speed splitting the granules. The form of granules can be improved by decreasing the diameter of the drum, by interchanging the shredding pin blades to broader cutting blades, by decreasing the number of blades on the sphere of the drum, and by choosing the ratio of driving speed and rotational speed properly.

52686 (VTT-OPT-17) **Development of planning of peat production area.** Koivu, T.; Leinonen, A. Technical Research Centre of Finland, Jyvaeskylae (Finland). Combustion and Thermal Engineering Lab. Jun 1990. 25p. (In Finnish). Project KTM-275/881/87. Order Number DE91707444. Source: NTIS (US Sales Only), PC A03/MF A01.

OPTIMITURVE Research Program.

Computer Aided Design (CAD) has become a very popular tool in industrial planning and it has also been applied to planning of peat production areas. The most common way to do this has been simplification and speeding up of the drawing phase of a peat production plan. However, the success in planning also leads to success in peat production during the whole productive age of the peatland. In addition to drawing the modern computer programs offer other possibilities for the planner. The planning process, and possible ways to effective the planning with the aid of a computer are described in this report. The forms of the surface and the bottom of a peatland may be examined by three dimensioned perspectives. Cost calculation may be simplified and speeded up in different sub-areas of planning. Different alternatives of ditchg may easily be drawn and examined in combination with in information of the surface and bottom layers as profile figures. Computation may also be used as an aid in placing the fields and stockpiles on the production area in order to optimize the productivity. VERAMAP and VERSACAD programs have been studied closer in this research. The both of these are used in planning of peat production areas. VERSACAD is a universal CAD program for micro computers, and the VERAMAP a map drawing program for work station computers.

52687 (VTT-OPT-18) **Costs of peat production.** Ahonen, M.; Hillebrand, K. Technical Research Centre of Finland, Jyvaeskylae (Finland). Combustion and Thermal Engineering Lab. May 1990.

28p. (In Finnish). Project KTM-275/881/87. Order Number DE91707446. Source: NTIS (US Sales Only), PC A03/MF A01.

OPTIMITURVE Research Program.

Costs of different milled and sod peat production methods are examined. In chapter two, the production costs and the relative shares of working phases of different production methods are considered. The new production methods, not considered earlier, are ridge drying and granulated peat production methods in sod peat production, multi-product method based on both sod and milled peat production and a method based on tractor-driven pneumatic harvester with a miller in milled peat production. In ridge drying method both sieving and scraper sod ridge methods are examined. In granulated peat production method sod peat ridger and pneumatic harvester methods are considered, respectively. Multi-product method and tractor-driven pneumatic harvester method with a miller are based on conventional sod and milled peat production methods. The production costs of each production method considered were higher than in milled peat Haku-method. Finally, the effects of variation of initial values on peat production costs are also examined. The results obtained are then compared to the computational basic case.

52688 (VTT-OPT–19) **Peat production control.** Hillebrand, K.; Ahonen, M. Technical Research Centre of Finland, Jyvaeskylae (Finland). Combustion and Thermal Engineering Lab. May 1990. 21p. (In Finnish). Project KTM-275/881/87. Order Number DE91707448. Source: NTIS (US Sales Only), PC A03/MF A01.

OPTIMITURVE Research Program.

A microcomputer based milled peat production control system is described. The control system can be applied to planning of one harvesting cycle of milled peat production. A continuously operating moisture meter and a thickness measuring system for the milled peat layer were also developed for the control system. The adjustment of the production plan is made using a field meteorological station and measurement of the moisture content of milled peat in real time. The measuring equipment and testing of the production control system are also described. Finally, the possibility to utilize numerical simulation in milled peat production control is considered.

52689 (VTT-OPT–20) **A calculation method for the efficiency of milled peat production.** Lindh, T. Technical Research Centre of Finland, Jyvaeskylae (Finland). Combustion and Thermal Engineering Lab. Jun 1990. 31p. (In Finnish). Project KTM-275/881/87. Order Number DE91707450. Source: NTIS (US Sales Only), PC A03/MF A01.

OPTIMITURVE Research Program.

Calculation method for the efficiency of milled peat production has been studied in this report, in order to estimate the rate of utilization of weather conditions in peat production. The method is based on the Soviet calculation method for net evaporation sum, and annual factors, calculated from seasonal net evaporation rates. The method takes long-term weather changes in consideration. Calculation of net evaporation is based on daily weather and evaporation data. The rains, and the delays after them in milled peat production are taken into account in the calculations. The method has been tested using production data obtained from Leivonmaeki, a peat production area owned by Vapo Oy, and long-term evaporation and weather data from Tikkakoski meteorological station. Description of the computerized model, estimation of possible sources of errors, and future needs for development and adjustment of the model are introduced in this report.

0130 Transport, Handling, and Storage

Refer also to citation(s) 52653, 52655, 52670, 53367

52690 (DOE/EIA–0125(90/2Q)) **Coal distribution, January–June 1990.** USDOE Energy Information Administration, Washington, DC (USA). Office of Coal, Nuclear, Electric and Alternate Fuels. 17 Oct 1990. 114p. Sponsored by U.S. DOE Energy Information Administration. Order Number DE91001730. Source: NTIS, PC A06/MF A01 - GPO - OSTI; GPO Dep.

The Coal Distribution report provides information on coal production, distribution, and stocks in the United States to a wide audience including Congress, federal and state agencies, the coal industry, and the general public. This issue presents information for January through June 1990. Coal distribution data are shown (in tables 1–34) by coal-producing state of origin, consumer use, method of transportation, and state of destination. 6 figs., 34 tabs.

52691 (DOE/PETC/TR–90/10) **Transportation costs for new fuel forms produced from low rank US coals.** Newcombe, R.J. (TMS, Inc., Germantown, MD (USA)); McKelvey, D.G.; Ruether, J.A. USDOE Pittsburgh Energy Technology Center, PA (USA). Sep 1990. 79p. Sponsored by U.S. DOE Fossil Energy. Order Number DE91000942. Source: NTIS, PC A05/MF A01 - OSTI; GPO Dep.

Transportation costs are examined for four types of new fuel forms (solid, syncrude, methanol, and slurry) produced from low rank coals found in the lower 48 states of the USA. Nine low rank coal deposits are considered as possible feedstocks for mine mouth processing plants. Transportation modes analyzed include ship/barge, pipelines, rail, and truck. The largest potential market for the new fuel forms is coal-fired utility boilers without emission controls. Lowest cost routes from each of the nine source regions to supply this market are determined. 12 figs.

52692 (EPRI-GS–6996) **Proceedings: Coal-handling systems, 1989.** Arnold, B.J. Electric Power Research Inst., Palo Alto, CA (USA); CQ, Inc., Homer City, PA (USA). ©Sep 1990. 251p. Sponsored by Electric Power Research Institute. (CONF-890129–: 1989 coal-handling systems, Pensacola, FL (USA), 24-27 Jan 1989). Source: Research Reports Center, Box 50490, Palo Alto, CA 94303.

Coal Handling Systems: The State of the Future, and EPRI conference held in Pensacola, Florida, January 24–27, 1989, featured technical papers on laboratory techniques for measuring the handling properties of coal and new technologies in coal handling, blending, pelletizing, and dewatering. During the conference, representatives from utilities, coal companies, chemical companies, equipment manufacturers, government, and universities discussed their experiences with coal handling systems, and efforts to control specific properties that affect coal handling characteristics. Such efforts included reducing moisture, cleaning fines to remove clay and other impuritites, reducing fines content, and controlling coal quality through on-line analysis and blending. Nineteen topics are presented in this report. Individual papers are processed separately for the data bases.

52693 (OY/PSTL-TIED–71) **Self heating of peat stockpiles and stopping of it with liquefied nitrogen.** Kauppi, H. Oulu Univ. (Finland). Research Inst. of Northern Finland. Mar 1990. 111p. (In Finnish). Order Number DE91707438. Source: NTIS (US Sales Only), PC A06/MF A01.

Economically significant losses may occur in stockpiling of peat. The losses caused by selfheating of stockpile often cause the earlier use of a stockpile than planned or at least the heated peat is removed from stockpile. Fire and extinguishing losses may also occur in the extreme conditions. Theory of selfheating of peat and suitability of liquefied nitrogen for cooling of heated stockpiles are discussed in this report. The suitable nitrogenation technique was determined by investigating the spreading of liquefied nitrogen in a cool stockpile and in sod peat place into a case. Cooling tests were made with liquefied nitrogen in real conditions. The economy of the method was also estimated. Heating of matter occur in some degree in stockpiling of organic matter. This microbiological disintegration process is caused by moulds, bacteria and microbes. The speed of disintegration is quided by nutrient content of the material, temperature, humidity and availability of oxygen. The self-heating tendency of peat is due to the concentration and properties of carbohydrates of peat. Microbial and enzymatic activity is the main source of heat in the first stage of selfheating, in temperatures below 40 deg C. When the temperature of a stockpile increases from 40 deg C to 50 deg C, portion of biochemical, physical and chemical changes in peat is increased. In temperatures above 60 deg C the main source of heat are chemical reactions occuring in peat. When the heating of the stockpile goes further Fe(II)oxalate, which forms self igniting compounds, is formed through ion exchange reactions.

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Refer also to citation(s) 52642, 52643, 52923, 53434

52694 (ANL/EAIS–1) **Markets for small-scale, advanced coal-combustion technologies: A screening analysis of Organization of Economic Co-operation and Development (OECD) countries.** Placet, M.; Kenkeremath, L.D.; Streets, D.G.; Dials, G.E.; Kern, D.M.; Nehring, J.L.; Szpunar, C.B. Argonne National Lab., IL (USA). Environmental Assessment and Information Sciences Div. Dec 1988. 122p. Sponsored by U.S. DOE Fossil Energy. DOE Contract W-31109-ENG-38. Order Number DE91000500. Source: NTIS, PC A07/MF A01 - OSTI; GPO Dep.

This report examines the potential of using US-developed advanced coal technologies (ACTs) for small combustors in foreign markets; in particular, the market potentials of the member countries of the Organization of Economic Co-operation and Development (OECD) were determined. First, the United States and those OECD countries with very low energy demands were eliminated. The remaining 15 countries were characterized on the basis of eight factors that would influence their decision to use US ACTs: energy plan and situation, dependence on oil and gas imports, experience with coal, residential/commercial energy demand, industrial energy demand, trade relationship with the United States, level of domestic competition with US ACT manufacturers, and environmental pressure to use advanced technology. Each country was rated high, medium-high, low-medium, or low on each factor, based on statistical and other data. The ratings were then used to group the countries in terms of their relative market potential (good, good but with impediments, or limited). The best potential markets appear to be Spain, Italy, turkey, Greece, and Canada. 25 refs., 1 fig., 37 tabs.

52695 (CRIEPI-EW–89003) **Combustion characteristics and NO_x emission of low BTU gas turbine in coal gasification combined cycle power generation system.** Sato, M.; Abe, T.; Ishikawa, H.; Yoshine, T.; Yamada, M.; Hisa, S. Central Research Inst. of Electric Power Industry, Tokyo (Japan). Jan 1990. 21p. Source: Central Research Institute of Electric Power Industry, Tokyo (Japan).

From the viewpoint of future coal utilization technology for thermal power generation, a coal gasification combined cycle system has attracted special interest recently. In the coal gasification combined cycle power generation system, it is necessary to develop a high temperature gas turbine combustor using low BTU gas (LBG), which has high thermal efficiency and low emission of pollutants. The coal-derived gaseous fuel has several specific features from the viewpoint of combustion; for example, its calorific value is approximately one-tenth of natural gas, main combustible components are carbon monoxide and hydrogen and a small amount of ammonia is contained in the fuel. This paper describes combustion characteristics and NO_x emission characteristics of a gas turbine combustor using coal-derived low BTU gaseous fuel. Combustion tests were conducted using a full-scale combustor used for the 150 MW gas turbine under atmospheric pressure. Furthermore, high pressure combustion tests were conducted by using a half-scale combustor used for the 150 MW gas turbine. 6 refs., 17 figs., 3 tabs.

52696 (CRIEPI-EW–89004) **Development of a low-NO_x LBG combustor for coal gasification combined cycle power generation systems.** Sato, M.; Abe, T.; Ninomiya, T.; Nakata, T.; Yoshine, T.; Hasegawa, H. Central Research Inst. of Electric Power Industry, Tokyo (Japan). Jan 1990. 19p. Source: Central Research Institute of Electric Power Industry, Tokyo (Japan).

From the viewpoint of future coal utilization technology for thermal power generation, the coal gasification combined cycle system has attracted special interest recently. It is necessary to develop a high temperature gas turbine combustor using low-BTU gas (LBG) which has high thermal efficiency and low emission of pollutants. In Japan, development of the coal gasification combined cycle power generation system was started in 1985 by the national government and Japanese electric companies. 1300°C class gas turbines will be developed. If the fuel gas cleaning system is a hot type, the coal gaseous fuel to be supplied to gas turbines will contain ammonia. Ammonia will be converted to nitric oxides in the combustion process in gas turbines. Therefore, low fuel-NO_x combustion technology will be one of the most important research subjects. This paper describes low fuel-NO_x combustion technology for 1300°C class gas turbine combustors using coal gaseous low-BTU fuel as well as combustion characteristics and carbon monoxide emission characteristics. Combustion tests were conducted using a full-scale combustor used for the 150 MW gas turbine at atmospheric pressure. Furthermore, high pressure combustion tests were conducted using a half-scale combustor used for the 150 MW gas turbine. 5 refs., 15 figs., 3 tabs.

52697 (CRIEPI-EW–89006) **Experimental evaluation of a low NO_x LBG combustor using bypass air.** Nakata, T.; Sato, M.; Ninomiya, T.; Yamauchi, K.; Fukazawa, M.; Abe, T.; Ishikawa, H.; Mandai, S.; Sato, N.; Mikata, K. Central Research Inst. of Electric Power Industry, Tokyo (Japan). Oct 1989. 19p. Source: Central Research Institute of Electric Power Industry, Tokyo (Japan).

A 150 MW, 1300°C (1573 K) class gas turbine combustor firing coal-gasified fuel has been designed. Main purpose of the present paper is first to estimate CO and NO_x emissions, and second to discuss the low NO_x combustion technology burning such a low-BTU gas. The full-scale, atmospheric-pressure combustion tests were conducted over a wide range of conditions using bypass air. The results are summarized as follows: a designed combustor has an excellent combustion efficiency of 99.6 percent even when the calorific value of fuel drops to 650 kcal/m^3N; CO and NO_x emissions can be estimated by the air ratio in primary combustion zone; the role of air bypass valve is important for low NO_x combustion, and to give stable combustion at lower load conditions; and ammonia conversion to NO_x is minimized with an optimum air ratio in primary combustion zone. 14 refs., 14 figs., 1 tab.

52698 (CRIEPI-EW–89008) **Analysis of coal-gasified fuel combustion reaction - thermal NO_x emission characteristics.** Nakata, T.; Sato, M. Central Research Inst. of Electric Power Industry, Tokyo (Japan). Oct 1989. 13p. Source: Central Research Institute of Electric Power Industry, Tokyo (Japan).

The purpose of this paper is to develop a numerical calculation method for gas turbine combustors using coal-gasified fuel. An elementary process model has been made to describe the chemical kinetics, and has predicted the thermal nitrogen oxides formation and carbon oxide decomposition in the combustor by solving numerically the time-dependent conservation equations for chemical species. The results of the analysis agreed with a variety of experimental data, and considerable progress has been made in developing an accurate chemical kinetics scheme for use in gas turbine combustor design. 7 refs., 7 figs., 2 tabs.

52699 (CRIEPI-EW–89009) **Flow and mixing characteristics of a gas turbine combustor using a water-flow model (Part 1).** Ninomiya, T.; Inumaru, J.; Abe, T.; Sato, M. Central Research Inst. of Electric Power Industry, Tokyo (Japan). Jan 1990. 43p. Source: Central Research Institute of Electric Power Industry, Tokyo (Japan).

Investigating the flow and mixing characteristics of combustors is important to the effective research and development of gas turbine combustors using coal gas. This report presents the results of an experimental study, conducted with a water-flow model, to investigate the flow and mixing characteristics of a Venturi combustor (CGT-3004) and an advanced rich-lean combustor with pilot flame (CGT-4001). The study confirmed that the sub-recirculation flow of the liner dorm has a significant effect on the flame stability of the CGT-3004 combustor. The study also confirmed that the flow pattern of the air from the lean combustion region is one in which the air flows in the reverse direction until it reaches the rich combustion region of the CGT-4001 combustor. 7 refs., 21 figs., 5 tabs.

52700 (CRIEPI-EW–89010) **Development of a gas turbine combustor for coal gasification. Part V.** Evaluation of rich-lean combustor with pilot flame. Central Research Inst. of Electric Power Industry, Tokyo (Japan). Jan 1990. 34p. Source: Central Research Institute of Electric Power Industry, Tokyo (Japan).

Tests were conducted on the combustion and emission characteristics of a 1300°C class rich-lean combustor with pilot flame. The results were as follows: the addition of an auxiliary chamber to

the combustor dramatically improved the flame stability in the primary zone in all load zones; by moving the second injection ports downward, it was possible to decrease, from 70% to 50%, the conversion ratio of ammonia to NO_x under full-load conditions with an outlet temperature at 1300°C; the combustion efficiency was about 99.6% under full-load conditions and 99.9% or higher with intermediate-load conditions; and the liner metal temperature distributions were 800°C or below at all locations. 6 refs., 23 figs., 4 tabs.

52701 (CRIEPI-EW–89011) **Development of gas turbine combustor for coal gasification. Part II.** Ninomiya, T.; Sato, M.; Abe, T.; Yamauchi, K.; Hisa, S.; Hasegawa, H.; Yoshine, T.; Yamada, M. Central Research Inst. of Electric Power Industry, Tokyo (Japan). Mar 1990. 33p. Source: Central Research Institute of Electric Power Industry, Tokyo (Japan).

From the viewpoint of future coal utilization technology for thermal power generation, the coal gasification combined cycle system has attracted special interest recently. It is necessary to develop a high temperature gas turbine combustor using low BTU gas (LBG) which has high thermal efficiency and low pollutant emissions. This paper describes low fuel NO_x combustion technology for a 1300°C class gas turbine combustor using coal gaseous low BTU fuel and also combustion characteristics and carbon monoxide emission characteristics are described. NO_x emission characteristics were studied on a full scale low BTU gas turbine combustor used in a 150 MW gas turbine in order to develop a low fuel NO_x combustor. As a result, rich-lean combustion method was effective to decrease fuel NO_x emissions resulting from ammonia in coal gaseous fuel. Ammonia conversion rate to NO_x decreased to about 50% under 100% load condition with 1300°C of the combustor exit gas temperature. This value was 20% lower than that of the CGT-1001 combustor which was not designed for low fuel NO_x combustion. 1 ref., 28 figs., 5 tabs.

52702 (CRIEPI-EW–89012) **Study on low-calorific gas combustion. Part 5.** Yamauchi, K.; Sato, M.; Nakata, T. Central Research Inst. of Electric Power Industry, Tokyo (Japan). Jan 1990. 29p. Source: Central Research Institute of Electric Power Industry, Tokyo (Japan).

This paper examines in detail the effects of the composition of coal-derived low-BTU gas (LBG) on combustion characteristics, particularly on NO_x emissions in the process of developing a low-NO_x gas turbine combustor for coal gasification. In the development of a low-NO_x combustor using two-stage combustion technology, the conversion to NO_x of NH_3 contained in the fuel was found to be very sensitive to the concentration of methane in the LBG. The lowest NH_3 conversion to NO_x was found at the distinctive primary combustion air ratio. 10 refs., 25 figs., 3 tabs.

52703 (CRIEPI-W–89010) **Development of a low BTU gas combustor.** Nakata, T.; Sato, M.; Ninomiya, T.; Yamauchi, K.; Fukazawa, M.; Abe, T.; Ishikawa, H.; Mandai, S.; Sato, N.; Mikata, K. Central Research Inst. of Electric Power Industry, Tokyo (Japan). Oct 1989. 33p. (In Japanese). Source: Central Research Institute of Electric Power Industry, Tokyo (Japan).

A 150-MW 1300°C (1573K) class gas turbine combustor for firing coal gasified fuel has been designed. Main purposes of the present paper are to estimate CO and NO_x emissions, and to discuss the low NO_x combustion technology for burning such a low-BTU gas. Full-scale atmospheric-pressure combustion tests were conducted over a wide range of conditions using bypass air. The results can be summarized as follows: The designed combustor has an excellent combustion efficiency of 99.6 percent even when the calorific value of fuel drops to 650 kcal/m^3N. CO and NO_x emissions can be estimated from the air ratio in the primary combustion zone. The role of an air bypass valve is important for low NO_x combustion, and to insure stable combustion at lower load conditions. Ammonia conversion to NO_x is minimized at an optimum air ratio in the primary combustion zone. 6 refs., 21 figs., 2 tabs.

52704 (DOE/FE–0206P) **Comprehensive report to Congress: Clean Coal Technology Program: Blast furnace granulated coal injection system demonstration project: A project proposed by: Bethlehem Steel Corporation.** USDOE Assistant Secretary for Fossil Energy, Washington, DC (USA). Office of Clean Coal Technology. Oct 1990. 22p. Sponsored by U.S. DOE Fossil Energy. Order Number DE91001069. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Bethlehem Steel Corporation (BSC), of Bethlehem, Pennsylvania, has requested financial assistance from DOE for the design, construction, and operation of a 2800-ton-per-day blast furnace granulated coal injection (BFGCI) system for each of two existing iron-making blast furnaces. The blast furnaces are located at BSC's facilities in Burns Harbor, Indiana. BFGCI technology involves injecting coal directly into an iron-making blast furnace and subsequently reduces the need for coke on approximately a pound of coke for pound of coal basis. BFGCI also increases blast furnace production. Coke will be replaced with direct coal injection at a rate of up to 400 pounds per NTHM. The reducing environment of the blast furnace enables all of the sulfur in the coal to be captured by the slag and hot metal. The gases exiting the blast furnace are cleaned by cyclones and then wet scrubbing to remove particulates. The cleaned blast furnace gas is then used as a fuel in plant processes. There is no measurable sulfur in the off gas. The primary environmental benefits derived from blast furnace coal injection result from the reduction of coke requirements for iron making. Reduced coke production will result in reduced releases of environmental contaminants from coking operations. 5 figs.

52705 (DOE/FE–0208P) **Comprehensive report to Congress: Clean Coal Technology Program: Arvah B. Hopkins circulating fluidized-bed repowering project: A project proposed by: The City of Tallahassee.** USDOE Assistant Secretary for Fossil Energy, Washington, DC (USA). Oct 1990. 25p. Sponsored by U.S. DOE Fossil Energy. Order Number DE91001076. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The project involves the repowering of a 250-megawatt electrical (MWe) natural gas- or oil-fired boiler with a coal-fired atmospheric circulating fluidized-bed (CFB) boiler to provide steam to an existing turbine generator. The boiler will be the largest of its type. After construction and shakedown, the City of Tallahassee (CoT) plant will be operated for 24 months with at least three different eastern coals. Final coal selection will be based on the Fuels Selection Study, which is part of Phase I-A of the project. Cost, financial, and technical data from the CoT CFB will be provided the utility industry for evaluation of a 250-MWe CFB as a commercially viable clean coal alternative. The objective of the Arvah B. Hopkins CFB Repowering Project is to demonstrate an efficient, economical, and environmentally superior method of generating electric power from coal. The work to be performed under the Cooperative Agreement includes the design, construction, and operation of the demonstration plant. 4 figs.

52706 (DOE/PC/40267–2) **Combustion characterization of coals for industrial applications: Second quarterly progress report, July 1–September 30, 1982.** Nsakala, N.; Patel, R.L.; Lao, T.C. Combustion Engineering, Inc., Windsor, CT (USA). Power Systems Group. Nov 1982. 14p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC22-81PC40267. Order Number DE83001838. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The five parent coals ear-marked for this study have been characterized. These coals include (1) a Texas (Wilcox) lignite; (2) a Montana (Rosebud) subbituminous; (4) an Alabama (Black Creek) high volatile bituminous; and (5) a Pennsylvania (Buck Mountain) anthracite. Samples for analyses were prepared in accordance with the ASTM standard (ASTM D 2013-72). The following ASTM analyses were performed on each coal: proximate, ultimate, higher heating value, Hardgrove grindability index, ash fusibility, and ash composition. Additionally, the flammability index (FI) of each coal was determined in an in-house apparatus. The FI is indicative of the ignition temperature of a given fuel on a relative basis. The combustion kinetic parameters (apparent activation energies and frequency factors) of Montana subbituminous and Pennsylvania anthracite chars have also been derived from data obtained in the Drop Tube Furnace System (DTFS). This information depicts the combustion characteristics of these two coal chars. 1 ref., 5 figs., 4 tabs.

52707 (DOE/PC/50271–T3-Vol.1) **Combustion and fuel characterization of coal-water fuels: Volume 1, Final summary**

report. Chow, O.K.; Gralton, G.W.; Lachowicz, Y.V.; Laflesh, R.C.; Levasseur, A.A.; Liljedahl, G.N. Combustion Engineering, Inc., Windsor, CT (USA). Feb 1989. 199p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC22-82PC50271. Order Number DE91000992. Source: NTIS, PC A09/MF A01 - OSTI; GPO Dep.

This five-year research project was established to provide sufficient data on coal-water fuel (CWF) chemical, physical, and combustion properties to assess the potential for commercial firing in furnaces designed for gas or oil firing. Extensive laboratory testing was performed at bench-scale, pilot-scale (4×10^6Btu/hr) and commercial-scale (25×10^6 to 50×10^6Btu/hr) on a cross-section of CWFs. Fuel performance characteristics were assessed with respect to coal properties, level of coal beneficiation, and slurry formulation. The performance of four generic burner designs was also assessed. Boiler performance design models were applied to analyze the impacts associated with conversion of seven different generic unit designs to CWF firing. Equipment modifications, operating limitations, and retrofit costs were determined for each design when utilizing several CWFs. Unit performance analyses showed significantly better load capacity for utility and industrial boilers as the CWF feed coal ash content is reduced to 5% or 2.6%. In general, utility units had more attractive capacity limits and retrofit costs than the industrial boilers and process heaters studied. Economic analyses indicated that conversion to CWF firing generally becomes feasible when differential fuel costs are above $1.00/$10^6$Btu. 60 figs., 24 tabs.

52708 (DOE/PC/50271–T3-Vol.2) **Combustion and fuel characterization of coal-water fuels: Volume 2, Selection and procurement of candidate coal-water fuels with commercial potential.** Combustion Engineering, Inc., Windsor, CT (USA). Jul 1989. 79p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC22-82PC50271. Order Number DE91000993. Source: NTIS, PC A05/MF A01 - OSTI; GPO Dep.

Pittsburgh Energy Technology Center (PETC) of the Department of Energy initiated a comprehensive effort in 1982 to develop the necessary performance and cost data and to assess the commercial viability of coal water fuels (CWFs) as applied to representative utility and industrial units. The effort comprised six tasks beginning with coal resource evaluation and culminating in the assessment of the technical and economic consequences of switching representative commercial units from oil to state-of-the-art CWF firing. Extensive bench, pilot and commercial-scale tests were performed to develop necessary CWF combustion and fireside performance data for the subsequent boiler performance analyses and retrofit cost estimates. This report (Volume 2) provides a review of the fuel selection and procurement activities. Included is a discussion on coal washability, transport of the slurry, and characterization. 20 figs., 26 tabs.

52709 (DOE/PC/50271–T3-Vol.3) **Combustion and fuel characterization of coal-water fuels: Volume 3, Bench-scale characterization of chemical, physical and combustion properties of coal-water fields.** Chow, O.K.; Patel, R.L.; Levasseur, A.A. Combustion Engineering, Inc., Windsor, CT (USA). Jul 1987. 56p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC22-82PC50271. Order Number DE91000994. Source: NTIS, PC A04/MF A01 - OSTI; GPO Dep.

Pittsburgh Energy Technology Center (PETC) of the Department of Energy initiated a comprehensive effort in 1982 to develop the necessary performance and cost data and to assess the commercial viability of coal-water fuels (CWFs) as applied to representative utility and industrial units. The effort comprised six tasks beginning with coal resource evaluation and culminating in the assessment of the technical and economic consequences of switching representative commercial units from oil to state-of-the-art CWF firing. Extensive bench, pilot and commercial-scale tests were performed to develop necessary CWF combustion and fireside performance data for the subsequent boiler performance analyses and retrofit cost estimates. Discussions on transport, rheology, combustion properties, and ash characterization are included. 11 refs., 9 figs., 7 tabs.

52710 (DOE/PC/50271–T3-Vol.4) **Combustion and fuel characterization of coal-water fuels: Volume 4, Commercial scale atomizer and burner evaluation of coal- water fuels.** Lachowicz, Y.V.; LaFlesh, R.C. Combustion Engineering, Inc., Windsor, CT (USA). Jul 1987. 71p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC22-82PC50271. Order Number DE91000995. Source: NTIS, PC A05/MF A01 - OSTI; GPO Dep.

This five-year research project was established to provide sufficient data on coal-water fuel (CWF) chemical, physical, and combustion properties to assess the potential for commercial firing in furnaces designed for gas or oil firing. Extensive laboratory testing was performed at bench-scale, pilot-scale (4×10^6Btu/hr) and commercial-scale (25×10^6 to 50×10^6Btu/hr) on a cross-section of CWFs. Fuel performance characteristics were assessed with respect to coal properties, level of coal beneficiation, and slurry formulation. The performance of four generic burner designs was also assessed. Boiler performance design models were applied to analyze the impacts associated with conversion of seven different generic unit designs to CWF firing. Equipment modifications, operating limitations, and retrofit costs were determined for each design when utilizing several CWFs. This report summarizes studies conducted under Task 4. The objective was to quantify CWF atomization and combustion properties utilizing industrial/utility scale equipment. Burners were evaluated and combustion performance differences identified for various CWF formulations. 12 refs., 23 figs., 6 tabs.

52711 (DOE/PC/50271–T3-Vol.5) **Combustion and fuel characterization of coal-water fuels: Volume 5, Pilot-scale ash deposition and performance testing of coal-water fuels.** Chow, O.K.; Durant, J.F.; Griffith, B.F.; Miemiec, L.S.; Levasseur, A.A.; Teigen, B.C. Combustion Engineering, Inc., Windsor, CT (USA). Jul 1987. 25p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC22-82PC50271. Order Number DE91000996. Source: NTIS, PC A05/MF A01 - OSTI; GPO Dep.

The ash deposition and performance behavior of a cross-section of coal-water fuels (CWFs) were investigated during comprehensive pilot-scale testing under Task 5 of the Department of Energy's Combustion and Fuel Characterization of Coal-Water Fuels project. The key results from this effort including combustion, furnace slagging, convective pass fouling, fly ash erosion and electrostatic precipitator collection characteristics of the test fuels, are summarized in this report. Data were obtained on twelve different CWFs as well as three baseline pulverized coals. Three coal types were fired at different levels of coal beneficiation to assess the effects of coal cleaning on performance. Five CWFs prepared from the same feed coal by different manufactures were tested to assess the effects of slurry processing. CWFs prepared from both standard grind and microfine grind coals were evaluated. In addition a microfine CWF was fired at fuel temperatures up to 220°F to evaluate the effect of thermal atomization on performance. 8 refs., 16 figs., 12 tabs.

52712 (DOE/PC/90511–T1) **Combustion of volatile matter during the initial stages of coal combustion: Final technical report.** Marlow, D.; Niksa, S.; Kruger, C.H. Stanford Univ., CA (USA). High Temperature Gasdynamics Lab. Aug 1990. 211p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FG22-86PC90511. Order Number DE91000819. Source: NTIS, PC A11/MF A01 - OSTI; GPO Dep.

Both the secondary pyrolysis and combustion of the volatiles from a bituminous coal will be studied. Devolatilization and secondary pyrolysis experiments will be conducted in a novel flow reactor in which secondary pyrolysis of the volatiles occurs after devolatilization is complete. This allows unambiguous measurements of the yields from both processes. Measurements will be made for reactor temperatures from 1500 to 1700 K, and a nominal residence time of 200 msec. These conditions are typical of coal combustion. Yields of tar, soot, H_2, CO, CH_4, and C_2 and C_3 hydrocarbons will be determined as a function of reactor temperature. The yields will be reported as a function of the temperature of the reactor. The instrumentation for temperature measurements will be developed during future studies. Combustion studies will be conducted in a constant volume bomb, which will be designed and constructed for this study. Tar and soot will be removed before introducing the volatiles to the bomb, so that only the combustion of the light gas volatiles will be considered. The burning velocities of light gas volatiles will be determined both as functions of mixture

stoichiometry and the temperature at which the volatiles are pyrolysed. 90 refs., 70 figs., 13 tabs.

52713 (EUR–12328-EN) **Coal-water slurry contribution to the European Economic Community's energy. A technical and economic study.** Variali, B. Rome Univ. (Italy). Dept. of Chemical Engineering. 1989. 452p. Source: Commission of the European Communities, Luxembourg.

Coal-water slurry is a technology recently developed with the purpose of making coal use more practical and environmentally acceptable, particularly in the 'clean' formulation. Intensive research and extensive testing has produced slurry formulations suitable for practical use and has ascertained the feasibility of adapting existing equipment to CWS-firing. In particular the boiler can be retrofitted in order to allow combustion of CWS, while the firing system and transportation and handling equipment originally designed for liquid fuels require only minimal design alteration. This work outlines the present status of CWS technology and provides guidelines and details concerning power plant adaptation. In the industrial, utility and residential/commercial sectors it is possible to replace substantial amounts of traditional oil-derived and gaseous fuels with CWS, thus making a valuable contribution to European Economic Community energy and respecting the environment protection rules, particularly when the Premium Fuel Formulation is adopted.

52714 (EUR–12472-EN) **Computer modelling of particle gas flow in fluidized bed combustion boilers.** Renkema, A.J.; Laken, R.A. van der; Duijm, N.J.; Welle, R. van der; Buis, D.; Beckum, F.P.H. van. Holland Energy Technology BV (Netherlands); Netherlands Organization for Applied Scientific Research TNO, The Hague (Netherlands). Div. of Technology for Society; Technische Hogeschool Twente, Enschede (Netherlands). 1990. 119p. Source: Commission of the European Communities, Luxembourg.

Thermohydraulic computer codes are used to describe the flow of coal and ash particles in flue-gases of fluidised bed combustion boilers. Two codes investigated, FLUENT and PHOENICS, both suffer from the problem of numerical diffusion in the solution of algebraic equations although the second order differencing scheme of the former code is effective in suppressing this. The code PARTRACK is based on a discrete (Monte Carlo simulation) method as particle trajectory model, making the particle flow calculations independent of the flow field calculations. Using body fitted coordinates made it difficult to set up the problem. Using rectangular coordinates, the calculations fail to show recirculation zones downstream of the flaps, which are found in experiments. Laminar calculations with a constant, low value for the viscosity give a distinct improvement. The application of PARTRACK to the case of an AFBC-internal gives encouraging agreement between particle calculations and actual measurements.

52715 (EUR–12546-EN) **Reduction of NO_x emissions in bubbling fluidized bed by staged combustion.** Tossaint, H.H.J.; Luttikholt, J.J.M.; Valk, M.; Bramer, E.A.; Wormgoor, J.W.; Bijvoet, U.H.C. Koninklijke Machinefabriek Stork NV, Hengelo (Netherlands); Technische Hogeschool Twente, Enschede (Netherlands); Nederlandse Centrale Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, The Hague (Netherlands). 1990. 31p. Source: Commission of the European Communities, Luxembourg.

The possibilities of achieving a substantial reduction in NO_x and SO_2 emissions with two-stage combustion in a fluidized bed are investigated. This process divides the combustion air so that the primary air flow is fed to the bed and the secondary air flow is introduced into the freeboard. Emissions below 200 mg/nm^3 (7%O_2) and an excellent combustion efficiency are easily realised. Initially the work was carried out in a 60 x 60 cm AFBC unit at Twente University. In the second phase the larger 4MWth TNO AFBB unit was engineered for two-stage combustion. The third phase comprised verification and optimisation of the TU findings at TNO. Although the trends could be up-graded the absolute emission levels were lower in the larger unit. Bed temperature reduction and the use of fine limestone lowered the SO_2 emission levels, as did higher primary air to coal ratios. CO emission is affected by bed and freeboard temperatures and the fly ash recycle rate. The secondary air injection procedure is crucial to the optimum design.

52716 (LA–11211-Vol.3) **Changuinola peat deposit of northwest Panama: Volume 3, End-use assessment.** Thayer, G.R.; Williamson, K.D. Jr.; Ramirez, A. Los Alamos National Lab., NM (USA). Sep 1990. 150p. (In English, Spanish). DOE Contract W-7405-ENG-36. Order Number DE91000886. Source: NTIS, PC A07/MF A01 - OSTI; GPO Dep.

We studied the economics of generating electricity in a 30-MW power plant using peat as a fuel. We calculated the breakeven point; that is, the point at which the cost of producing electricity from a coal- or an oil-fueled facility was equal to the cost of producing electricity from a peat-fueled facility, both a fluidized-bed and a conventional suspension boiler and for wet-mined and milled peat production. In the base case, the price range for oil was assumed to be $0.09 to $0.108 per liter, and the price range for coal was assumed to be $35 to $42 per metric ton. Parametric studies were done varying the capacity factor, real cost of money, and the mining costs. The parametric studies indicate that a peat-fueled plant can remain competitive with an oil-fueled plant when each of the parameters, considered separately, have the following values: (1) capacity factor greater than 65%; (2) real cost of money less than 9%; and (3) actual peat mining cost, not exceeding the estimated cost by more than 25%. 9 refs., 15 figs., 8 tabs.

52717 (VTT-SYMP–107, pp. 83-112) **Advanced combustion methods for low grade coal utilization.** Beer, J.M. (Massachusetts Institute of Technoloy, Cambridge, MA (USA)). Valtion Teknillinen Tutkimuskeskus, Espoo (Finland). 1989. (CONF-890668–Vol.1: Symposium on low-grade fuels, Helsinki (Finland), 12-16 Jun 1989). In *Low-grade fuels: Volume 1.* 376p. Order Number DE91707607. Source: NTIS (US Sales Only), PC A17/MF A01.

Clean utilization of coals in power generation requires combinations of combustion process modifications for reduced pollutant emissions with the application of high energy-efficiency power cycles. Improved understanding of the mechanisms of nitrogen oxides formation has prepared the ground for the wide spread application of staged air and staged fuel injection for NO_x emission control. Methods of low NO_x burners and NO_x-reburn can be used in combination with those of post combustion NO_x clean up when very low NO_x emission has been achieved. In-furnace sulfur capture in high-temperature pulverized coal-fired furnaces is only partially successful because of the instability of the product sulfate at high temperatures. New developments with the use of ion-exchangeable water-soluble sorbents may bring improvements. Sulfur capture in fluidized combustion is generally successful mainly due to the lower temperature in the fluidized combustor. It is an additional advantage of fluidized combustion that it is amenable to incorporation into high-efficiency combined gas turbine-steam power cycles. Of the great variety of such power cycles the air heater cycles with topping combustor seem to be expecially favorable because they offer high efficiency at a relatively low technical risk. Topping combustors can be operated by a clean fuel like natural gas or by burning the products of pyrolysis of the feed coal of the fluidized combustor. The use of the topping combustor is raising significantly the power to process heat ratio for such a system designed for cogeneration.

52718 (VTT-SYMP–107, pp. 67-80) **Combustion of low grade fuels in Finland.** Saviharju, K. Valtion Teknillinen Tutkimuskeskus, Espoo (Finland). 1989. (CONF-890668–Vol.1: Symposium on low-grade fuels, Helsinki (Finland), 12-16 Jun 1989). In *Low-grade fuels: Volume 1.* 376p. Order Number DE91707607. Source: NTIS (US Sales Only), PC A17/MF A01.

Low grade fuels in Finland include peat and wood waste from pulp and paper industry and meet 14% of the energy consumption. Typical features of the fuels are a high volatile content, which makes them reactive and a high moisture content. Special measures are required in fuel handling. From an environmental point of view, the Finnish low-grade fuels are easier than coal (wood waste) or comparable (peat).

52719 (VTT-SYMP–107, pp. 113-133) **Combustion of low-grade fuels in utility boilers.** Breucker, H. (Vereinigte Kesselwerke AG, Duesseldorf (Germany, F.R.)). Valtion Teknillinen Tutkimuskeskus, Espoo (Finland). 1989. (CONF-890668–Vol.1: Symposium on low-grade fuels, Helsinki (Finland), 12-16 Jun 1989). In *Low-grade fuels: Volume 1.* 376p. Order Number DE91707607. Source: NTIS (US Sales Only), PC A17/MF A01.

From the large number of steam generator plants built by Vereinigte Kesselwerke AG of Duesseldorf for firing low-grade fuels the operating results for three selected plants are presented. It is shown how brown coals of different origins, with the most difficult fuel and ash compostions, can be fired in the most economical way in utility boilers. The design of the steam generators and firing systems selected with particular care has fully proven successful. By means of suitable modifications to individual components of the firing system optimum operating results adapted to the respective fuel characteristics could be obtained. The availability of the plants ranges now at values between 90 and 95% and thus exceeds the average of other plants fired with normal fuels.

52720 (VTT-SYMP–107, pp. 135-146) **Pulverized-coal swirl burner for combustion of dirty fuels.** Effenberger, H. (Technische Hochschule Zittau, Zittau (German Democratic Republic)). Valtion Teknillinen Tutkimuskeskus, Espoo (Finland). 1989. (CONF-890668–Vol.1: Symposium on low-grade fuels, Helsinki (Finland), 12-16 Jun 1989). In *Low-grade fuels: Volume 1.* 376p. Order Number DE91707607. Source: NTIS (US Sales Only), PC A17/MF A01.

Experimental flame modelling and calculating algorithms derived enable the representation of the complex aerodynamics of highly twisted flame jets, their influence on the combustion process being considered. Applying similarity consideration fundamentals on test planning results in increasing the conclusiveness and improving the transferability of model investigations. The swirl burner is well uited for diminishing steam generator slagging due to its short flames in case of super-critical design, which prevents wall contacts.

52721 (VTT-SYMP–107, pp. 247-260) **Procedures for evaluating the performance of low-grade fuels.** Pohl, J.S. (Energy Systems Associates, Tustin, CA (USA)). Valtion Teknillinen Tutkimuskeskus, Espoo (Finland). 1989. (CONF-890668–Vol.1: Symposium on low-grade fuels, Helsinki (Finland), 12-16 Jun 1989). In *Low-grade fuels: Volume 1.* 376p. Order Number DE91707607. Source: NTIS (US Sales Only), PC A17/MF A01.

More than a million U.S. dollars can be saved by reducing outages caused by slagging and fouling. This paper presents criteria for development and use of slagging and fouling indices and suggests that currently available indices cannot be used to control boiler operation and minimize outages caused by slagging and fouling. The paper shows that the rate of loss of heat absorption and the ability to recovery the rate of absorption using soot blowers can be correlated with a simple empirical expression. THe empirical expression for slagging cannot be correlated using normally measured properties of the coal and ash. The empirical expression for fouling appears to correlate with FGET/IDT and lb $Na_2O/10^6$ Btu. Finally this paper presents a technique to develop on-line and use empirical correlations of of slagging and fouling to optimize performance and reduce the cost of power generation.

52722 (VTT-SYMP–107, pp. 209-226) **Pressurized fluidized bed combustion of Spanish black lignite. Test experience, design and construction of a commercial scale PFBC plant in Spain.** Jansson, S.A. (ABB Carbon AB, Finspong (Sweden)). Valtion Teknillinen Tutkimuskeskus, Espoo (Finland). 1989. (CONF-890668–Vol.1: Symposium on low-grade fuels, Helsinki (Finland), 12-16 Jun 1989). In *Low-grade fuels: Volume 1.* 376p. Order Number DE91707607. Source: NTIS (US Sales Only), PC A17/MF A01.

One unit at the Escatron power station in the Aragon region of Spain is currently being repowered with Pressurized Fluidized Bed Combustion (PFBC) technology. Construction is underway, following periods of PFBC rig testing at ABB Carbon's Component Test Facility (CTF) in Sweden, and an extensive design effort. Empresa National de Electricidad S.A. (ENDESA), the largest utility in Spain, has selected PFBC as the most promising alternative for coal-fired generating capacity in Spain during the next decade. A high thermal efficiency, excellent environmental characteristics, the capability of using low-quality, high-ash coals and the opportunity for Spanish industry to participate in the construction as well as continued development of the PFBC technology were deciding factors in favour of PFBC. The high-sulfur, high-ash black lignite to be burnt at the Escatron PFBC plant is a difficult fuel in many respects. Following successful operation at Escatron it is expected that a number of commercial PFBC plants in the 300 to 350 MW_e size range will be installed in Spain before the end of the century. The European Community supports the project under its Energy Demonstration program. Some Spanish organizations are also participating financially in the project. ABB Carbon and its partners are also building PFBC plants in Sweden and in the U.S. These, as well as the Escatron PFBC plant, will be commissioned in 1990.

52723 (VTT-SYMP–107, pp. 227-245) **Effect of coal quality and fraction composition on firing conditions in circulating fluidized bed boiler.** Shakaryan, R.Y. (All-Union Heat Engineering Institute, Moscow (USSR)); Kurmangaliyev, M.R.; Sulejmenov, K.A.; Petroyan, R.A.; Nadyrov, I.I.; Mukanov, B.K. Valtion Teknillinen Tutkimuskeskus, Espoo (Finland). 1989. (CONF-890668–Vol.1: Symposium on low-grade fuels, Helsinki (Finland), 12-16 Jun 1989). In *Low-grade fuels: Volume 1.* 376p. Order Number DE91707607. Source: NTIS (US Sales Only), PC A17/MF A01.

Extensive investigations are carried out in the USSR on firing low-grade high-ash lignites, bituminous coal and anthracite in circulating fluidized bed (CFB) boilers. The paper presents the results on firing these coals of various fraction compositions in 0.25 and 3.0 MW experimental facilities. Using the data of fraction compositions of circulating fly ash a computer code has been developed. Thus, CFB heat transfer coefficients, hydrodynamics and system parameters have been correlated. Also it has been shown how sulfur fixation and NO_x formation depend on coal quality and firing conditions on CFB. The proposed computer code and test results are used for designing 160 t/h, 500 t/h and higher capacity CFB boilers.

0150 Economic, Industrial, and Business Aspects

Refer also to citation(s) 52690, 52716, 53101, 53123

52724 **Closing the efficiency gap: barriers to the efficient use of energy.** Hirst, E. (Oak Ridge National Laboratory, Oak Ridge, TN (USA)); Brown, M. *Resources, Conservation and Recycling (Netherlands),* 3(4): 267-281 (Jun 1990).

Only half of the potential for improving U.S. energy efficiency over the next 20 years is likely to be achieved, given current government policies and programs. This large untapped potential to save money, improve environmental quality, and reduce the foreign trade deficit exists because of structural and market barriers that inhibit adoption of cost-effective energy-efficient practices and measures. Structural barriers include distortions in fuel prices, uncertainty about future fuel prices, limited access to capital, government fiscal and regulatory policies, codes and standards, and supply infrastructure limitations. Behavioural barriers include attitudes toward energy efficiency, perceived risk of energy-efficiency investments, information gaps, and misplaced incentives. 41 refs., 2 figs., 2 tabs.

0160 Health and Safety

52725 (PB–90-265406/XAB) **Seal-breaching operation in Quinland Coal Mine: A case study. Information Circular/1988.** Doyle-Coombs, D.M.; Hansford, R. Bureau of Mines, Washington, DC (USA). 1988. 28p. (BUMINES-IC–9207). Source: NTIS, PC A03/MF A01.

Also available from Supt. of Docs. Library of Congress catalog card No. 88-600214.

In late July 1985, air samples from a sealed portion of the Quinland coal mine in West Virginia showed the presence of carbon monoxide (CO). Mine Safety and Health Administration (MSHA) personnel concluded that a fire was burning behind the seals. Since an imminent danger existed, the mine operator was given a closure order. The gases behind the seals were monitored, and almost 2 million ft of carbon dioxide (CO_2) gas was pumped into the sealed area to stabilize the environment. Sixteen days after the closure order was issued, MSHA allowed the mine to return to production. Approximately 1 year later, mine management submitted a seal breaching request to MSHA in order to drive a set of entries to further develop the mine. The Bureau of Mines established a sampling strategy and monitored gases from behind the sealed area during the breaching operation until the atmosphere was safe. The report is an account of the seal breaching conducted by the mine, MSHA, and the Bureau.

52726 (PB–90-265448/XAB) **Rollover protective structure (ROPS) performance criteria for large mobile mining equipment. Information Circular/1988.** Swan, S.A. Bureau of Mines, Washington, DC (USA). 1988. 22p. (BUMINES-IC–9209). Source: NTIS, PC A03/MF A01.

Also available from Supt. of Docs. See also PB–85-235786. Library of Congress catalog card No. 88-600283.

Certain types of mobile surface mining equipment are required to be equipped with rollover protective structures (ROPS) capable of protecting the operator in case of a rollover accident. The Bureau of Mines has developed ROPS performance criteria for wheeled front-end loaders. The report reviews the development of rollover test procedures and subsequent testing of ROPS for 52,000-, 286,000-, and 390,000-lb gross vehicle weight (GVW) loaders. The program consisted of both dynamic (roll) and static tests to assist in the development of the ROPS performance criteria. Each test included extensive instrumentation and photographic documentation to fully evaluate the performance of the ROPS. Data summarizing side, longitudinal, and vertical force and deflections are included. The data indicate that for loaders in excess of 240,000 lb, GVW, a side force-to-mass ratio of 1.0 and an energy-to-mass ratio of 6.0 appear to be adequate criteria to protect an operator in the event of a 540 deg rollover. For smaller machines, Society of Automotive Engineers (SAE) J1040 performance criteria provide adequate protection. Longitudinal loading, though not addressed in previous ROPS performance criteria, was shown to be a potentially significant factor in ROPS failure. Longitudinal loading and energy criteria equal to 80 pct of side loading criteria are recommended.

52727 (PB–90-265554/XAB) **Characterization of the 1986 coal-mining work force. Information Circular/1988.** Butani, S.J.; Bartholomew, A.M. Bureau of Mines, Washington, DC (USA). 1988. 70p. (BUMINES-IC–9192). Source: NTIS, PC A04/MF A01.

Also available from Supt. of Docs. Library of Congress catalog card No. 88-600142.

In 1986, the Bureau of Mines conducted a probability sample survey, Mining Industry Population Survey, to measure such employee characteristics as occupation; principal equipment operated; work location at the mine; present job, present company, and total mining experience; job-related training during the last 2 years; age; sex; race; and education. The population estimates are necessary to properly analyze the Mine Safety and Health Administration (MSHA) injury (includes illness and fatality data) statistics; that is, to compare and contrast injury rates for various subpopulations in order to identify those groups that are exhibiting higher than average injury rates. The report uses the survey's results to characterize the U.S. coal mining workforce from March through September 1986.

52728 (PB–90-266610/XAB) **Application of stereoscopic (3-D) slides to roof and rib hazard-recognition training. Information Circular/1988.** Barrett, E.A.; Wiehagen, W.J.; Peters, R.H. Bureau of Mines, Washington, DC (USA). 1988. 22p. (BUMINES-IC–9210). Source: NTIS, PC A03/MF A01.

Also available from Supt. of Docs. Library of Congress catalog card No. 88-6002634.

The ability to recognize visual cues commonly associated with roof and rib hazards is fundamental to the prevention of groundfall accidents. The perceptual skills that miners possess to visually search and assess hazardous ground conditions differ considerably. The U.S. Bureau of Mines report summarizes recent investigations on the use of stereoscopic (3-D) slides as a training aid for improving the ability of miners to recognize the various geologic and mining-induced irregularities that cause groundfalls. The feasibility of using 3-D slides for training and their effectiveness for representing roof and rib hazard conditions are discussed. Information is presented on equipment and procedures for creating a 3-D slide program that can be updated by mine trainers. Recommendations are made on selection of 3-D equipment and on the use of 3-D slides for training miners to recognize roof and rib hazards.

52729 (PB–90-266636/XAB) **Roof and rib fall accident and cost statistics: An in-depth study. Information Circular/1987.** Pappas, D.M. Bureau of Mines, Washington, DC (USA). 1987. 26p. (BUMINES-IC–9151). Source: NTIS, PC A03/MF A01.

Also available from Supt. of Docs. Library of Congress catalog card No. 87-600117.

The purpose of the Bureau of Mines study of U.S. roof and rib (roof-rib) accident statistics and related accident costs is to define current accident trends (1980-84) associated with fatal and nonfatal roof-rib fall accidents. Data were retrieved from a data base containing all recorded U.S. mining accidents, then sorted and normalized utilizing a computer software program. The statistics indicate that roof-rib accidents have significantly declined in the 5-year study period. Moreover, they indicate that there have been increases and/or patterns of roof-rib accidents associated with specific mine characteristics such as seam height, mine size, geographic location, and seasonal variation. Also, roof-rib injury characteristics produced pattern changes involving worker activity, lost workdays, types of injury, and severity of injury. A conservative estimate indicates that there has been a 30% adjusted increase in the cost of a roof-rib accident over the 5-year study period.

52730 **Explosion-suppression system.** Sapko, M.; Cortese, R. To Department of the Interior, Washington, DC. USA Patent Application 7-555,211. 19 Jul 1990. 16p. Source: NTISPC N03/MF A01.

This Government-owned invention available for U.S. licensing and, possibly, for foreign licensing. Copy of application available NTIS.

In accordance with the present invention, an explosion suppression system and triggering apparatus are provided for quenching gas and dust explosions where such explosions are characterized by a flame propagating along a path. The suppression system includes an electrically actuated suppression means for dispensing an extinguishing agent into the path ahead of the propagating flame. A triggering device for the suppression means then includes a light powered triggering means located upstream along the path of the propagating flame from the suppression means. This light powered triggering means receives light from the propagating flame and converts this light to an electrical actuation signal for the suppression means.

02 PETROLEUM

0202 Reserves, Geology, and Exploration

Refer also to citation(s) 53119, 53924

52731 (DOE/FE–0205P) **Investigation on the continued production of the Naval Petroleum Reserves beyond April 5, 1991.** USDOE Assistant Secretary for Fossil Energy, Washington, DC (USA). Office of Petroleum Reserves. Sep 1990. 93p. Sponsored by U.S. DOE Fossil Energy. Order Number DE91000072. Source: NTIS, PC A05/MF A01 - OSTI; GPO Dep.

The authority to produce the Naval Petroleum Reserves (NPRs) is due to expire in April 1991, unless extended by Presidential finding. As provided in the Naval Petroleum Reserves Production act of 1976 (Public Law 94-258), the President may continue production of the NPRs for a period of up to three years following the submission to Congress, at least 180 days prior to the expiration of the current production period, of a report that determines that continued production of the NPRs is necessary and a finding by the President that continued production is in the national interest. This report assesses the need to continue production of the NPRs, including analyzing the benefits and costs of extending production or returning to the shut-in status that existed prior to 1976. This continued production study considers strategic, economic, and energy issues at the local, regional, and national levels. 15 figs., 13 tabs.

0203 Drilling and Production

Refer also to citation(s) 52756

52732 (DOE/BC–90/1) **Contracts for field projects and supporting research on enhanced oil recovery: Progress review No. 61, quarter ending December 31, 1989.** USDOE Assistant Secretary for Fossil Energy, Washington, DC (USA). Office of Oil, Gas and Shale Technology; USDOE Bartlesville Project Office, OK (USA). Sep 1990. 125p. Sponsored by U.S. DOE Bartlesville Project Office. Order Number DE90000231. Source: NTIS, PC A07/MF A01 - OSTI; GPO Dep.

Contract information and research on Enhanced Recovery of Petroleum are briefly described. (CBS)

52733 (Juel–2361) **Injection steam generation for the enhanced oil recovery with underground methanation plant.** Pyc, I. Forschungszentrum Juelich GmbH (Germany, F.R.). Inst. fuer Sicherheitsforschung und Reaktortechnik; Technische Hochschule Aachen (Germany, F.R.). May 1990. 139p. (In German). Order Number DE91717163. Source: NTIS (US Sales Only), PC A07/MF A01.

In the future the enhanced oil recovery, and to a great extent its thermal sub-groups, will gain a special importance. Beside the conventional, on the surface of the earth occuring generation of process steam, a little HTR can be inserted as heat source in the frame of the nuclear long-distance heat systems. The steam generation ensues very close to the oil deposit during the exothermal methanation process. For this special application of the HTR concepts for steam injection were developed with inside-cooled methanation plants. Two reference-plants were chosen and their components were designed. The process technical problems in the conception of such steam injection plants were considered and future tasks were defined. (orig.).

52734 **In-situ stresses: The predominant influence on hydraulic fracture containment.** Warpinski, N.R. (Sandia National Labs., Albuquerque, NM (USA)); Schmidt, R.A.; Northrop, D.A. pp. 100-111 of Hydraulic fracturing-1: SPE Reprint Series No. 28. Society of Petroleum Engineers, Richardson, TX (USA) (1989). pp. 473

In-situ experiments, which are accessible by mineback, have been conducted to determine the parameters that control hydraulic fracture containment. These experiments demonstrate that a stress contrast between the pay zone and a bounding layer is the most important factor controlling fracture height. Material property interfaces are shown to have little effect.

0204 Processing

52735 (DOE/EIA–0536) **The US petroleum refining industry in the 1980's.** USDOE Energy Information Administration, Washington, DC (USA). Office of Oil and Gas. 11 Oct 1990. 92p. Sponsored by U.S. DOE Energy Information Administration. Order Number DE91001726. Source: NTIS, PC A05/MF A01 - GPO - OSTI; GPO Dep.

As part of the EIA program on petroleum, The US Petroleum Refining Industry in the 1980's, presents a historical analysis of the changes that took place in the US petroleum refining industry during the 1980's. It is intended to be of interest to analysts in the petroleum industry, state and federal government officials, Congress, and the general public. The report consists of six chapters and four appendices. Included is a detailed description of the major events and factors that affected the domestic refining industry during this period. Some of the changes that took place in the 1980's are the result of events that started in the 1970's. The impact of these events on US refinery configuration, operations, economics, and company ownership are examined. 23 figs., 11 tabs.

0206 Health and Safety

52736 (PB–90-258054/XAB) **Seismic hazard along a crude oil pipeline in the event of an 1811-1812 type New Madrid earthquake. Technical report.** Hwang, H.H.M.; Chen, C.H.S. Memphis State Univ., TN (USA). Center for Earthquake Research and Information. 16 Apr 1990. 69p. Grant NSF-ECE86-07591. Source: NTIS, PC A04/MF A01.

An assessment of the seismic hazard that exists along the major crude oil pipeline running through the New Madrid seismic zone from southeastern Louisiana to Patoka, Illinois is examined in the report. An 1811-1812 type New Madrid earthquake with moment magnitude 8.2 is assumed to occur at three locations where large historical earthquakes have occurred. Six pipeline crossings of the major rivers in West Tennessee are chosen as the sites for hazard evaluation because of the liquefaction potential at these sites. A seismologically-based model is used to predict the bedrock accelerations. Uncertainties in three model parameters, i.e., stress parameter, cutoff frequency, and strong-motion duration are included in the analysis. Each parameter is represented by three typical values. From the combination of these typical values, a total of 27 earthquake time histories can be generated for each selected site due to an 1811-1812 type New Madrid earthquake occurring at a postulated seismic source.

0207 Economic, Industrial, and Business Aspects

Refer also to citation(s) 52760, 52762

52737 (DOE/EIA–0380(90/07)) **Petroleum marketing monthly, July 1990.** USDOE Energy Information Administration, Washington, DC (USA). Office of Oil and Gas. 5 Oct 1990. 185p. Sponsored by U.S. DOE Energy Information Administration. Order Number DE91001198. Source: NTIS, PC A09/MF A01 - GPO - OSTI; GPO Dep.

The Petroleum Marketing Monthly (PMM) is designed to give information and statistical data about a variety of crude oils and refined petroleum products. The publication provides statistics on crude oil costs and refined petroleum products sales for use by industry, government, private sector analysts, educational institutions, and consumers. Data on crude oil include the domestic first purchase price, the f.o.b. and landed cost of imported crude oil, and the refiners' acquisition cost of crude oil. Sales data for motor gasoline,distillates, residuals, aviation fuels, kerosene, and propane are presented. 12 figs., 55 tabs.

52738 (DOE/EIA–0520(90/10)) **International petroleum statistics report, October 1990.** USDOE Energy Information Administration, Washington, DC (USA). Office of Energy Markets and End Use. 30 Oct 1990. 48p. Sponsored by U.S. DOE Office of Administration and Human Resource Management. Order Number DE91001756. Source: NTIS, PC A03/MF A01 - GPO - OSTI; GPO Dep.

The International Petroleum Statistics Report presents data on international oil production, consumption, imports, exports, and stocks. The report has three sections. Section 1 contains time series on world oil production, and on oil consumption and stocks in the Organization for Economic Cooperation and Development (OECD). This section contains annual data beginning in 1973, and monthly data for the most recent two years. Section 2 presents an oil supply/consumption balance for the market economies (i.e. noncommunist countries). This balance is presented in quarterly intervals for the most recent two years. Section 3 presents data on oil imports by OECD countries. This section contains annual data beginning in 1982, and quarterly data for the most recent two years. 15 refs., 25 tabs.

0208 Waste Management

Refer also to citation(s) 52668

0209 Environmental Aspects

Refer also to citation(s) 52736

52739 (DOE/ER/12101–1) **Photoassisted oxidation of oil films on water: Progress report, January 1990–December 1990.** Heller, A.; Brock, J.R. Texas Univ., Austin, TX (USA). Dept. of Chemical Engineering. Oct 1990. 5p. Sponsored by U.S. DOE Energy Research. DOE Contract FG05-90ER12101. Order Number DE91000982. Source: NTIS, PC A01/MF A01 - OSTI; GPO Dep.

The objective of the project is to develop a method for the solar assisted oxidation of oil slicks. A semiconducting photocatalyst, titanium dioxide, is used. Upon absorbing a photon, an electron-hole pair is generated in the TiO_2 microcrystal. The electron reacts with surface-adsorbed oxygen, reducing it to hydrogen peroxide; the hole directly oxidizes adsorbed organic compounds. Titanium dioxide is denser than either oil or seawater; the density of its anatase phase is 3.8 and that of its rutile phase is 4.3. In order to keep the titanium dioxide at the air/oil interface, it is attached to a low density, floating material. The particles of the latter are sufficiently small to make the system economical. Specifically, the photocatalyst particles are attached to inexpensive hollow glass microbeads

of about 100μm diameter. Those areas of the microbeads that are not covered by photocatalyst are made oleophilic, so that the microbeads will follow the oil slick and not migrate to either the air/water or the water/oil interface.

52740 (PB–90-260134/XAB) **Outer Continental Shelf Environmental Assessment Program. Final reports of principal investigators. Volume 67.** National Ocean Service, Anchorage, AK (USA). Ocean Assessments Div. Jul 1990. 634p. Source: NTIS, PC A99/MF A04.

See also Volume 63, PB–90-115718.

The contents of this study include the following: distribution, abundance, and biology of blue king and Korean hair crabs around the Pribilof Islands; distribution, abundance, and diversity of the epifaunal benthic organisms in Alitak and Ugak bays, Kodiak Island, Alaska; distribution and abundance of some epibenthic invertebrates of the northeastern Gulf of Alaska with notes on the feeding biology of selected species; reproductive success in Dungeness crab (Cancer magister) during long-term exposures to oil-contaminated sediments; and distribution and abundance of decapod larvae of the Kodiak shelf.

52741 (PB–90-261702/XAB) **Annotated bibliography: Fisheries Species and Oil/Gas Platforms, offshore California.** Allen, M.J.; Cowen, R.K.; de Wit, L.A.; Kauwling, T.J.; Love, M.S. MBC Applied Environmental Sciences, Inc., Costa Mesa, CA (USA). Feb 1987. 305p. Contract MMS-14-12-0001-30294. Source: NTIS, PC A14/MF A02.

See also PB–90-261728.

The document (MMS OCS Study 86-0092) is essentially an appendix to two other MMS reports, the Ecology of Important Fisheries Species Offshore California (MMS OCS Study 86-0093) and the Ecology of Oil/Gas Platforms Offshore California (MMS OCS Study MMS 86-0094). The document consists of more than 950 annotated citations of the biology and fisheries of 32 fish and invertebrate species of commercial and recreational importance in the marine waters of California. In the hard-copies provided to MMS, the citations are arranged alphabetically by the senior authors last names. The bibliography has also been provided on floppy disks for use with the Sci-Mate Software System (produced and registered by the Institute for Scientific Information) on IBM-PC compatible computers. In this format and using the Sci-Mate Manager, the bibliography can be updated as desired, and searched, sorted and retrieved by author, date, species names, and various key words.

52742 (PB–90-261728/XAB) **Ecology of Oil/Gas Platforms Offshore California.** Allen, M.J.; Cowen, R.K.; Kauwling, R.J.; Mitchell, C.T. MBC Applied Environmental Sciences, Inc., Costa Mesa, CA (USA). Feb 1987. 106p. Contract MMS-14-12-0001-30294. Source: NTIS, PC A06/MF A01.

See also PB–90-261710.

The report summarizes the ecology of fishes and attached epifauna that associate with offshore oil and gas platforms of California and an evaluation of actual and potential use of the platforms for mariculture. The attached invertebrate biota in the upper 35 m of the water column is dominated by bay (Mytilus edulis) or California (M. californianus) mussels, depending upon location and/or age of the structure, with other mollusks, barnacles and polychaetes being of secondary importance. The attached community may take up to five years to fully develop. The fish fauna at shallow (less than 45 m of water), nearshore platforms is dominated by surfperches and rockfishes; major species in this assemblage are about equally divided between those with relatively large mouths (which consume large organisms such as crabs and small fish) and those with relatively small mouths (which graze on small epifauna and planktonic organisms). The fish fauna may take two years to attain a relatively stable community structure. The fish fauna at nearshore platforms is similar to that at natural reefs and oil islands in the area, but is more diverse among common species. As opposed to these other structures, platforms lack fish which associated with algae.

52743 (PB–90-263070/XAB) **Role of microorganisms in the bioremediation of the oil spill in Prince William Sound, Alaska.** Rogers, J.E.; Araujo, R.; Pritchard, P.H.; Tabak, H.H. Environmental Protection Agency, Athens, GA (USA). Environmental Research Lab. 1990. 15p. (EPA–600/D-90/119). Source: NTIS, PC A03/MF A01.

The U.S. Environmental Protection Agency's Alaskan Bioremediation Project was initiated in the aftermath of the March 24, 1989, EXXON VALDEZ oil spill. The objective of the project was to demonstrate an alternative cleanup method for oil-contaminated shorelines based on enhancing natural biodegradation of the oil through the addition of nitrogen and phosphorus nutrients. The enhancement process is a well-recognized and scientifically sound approach to bioremediation but had never been tested on a large scale in marine environments. The project was managed by EPA's Office of Research and Development with financial, scientific, and logistical support from the Exxon Company USA under the authority of the Federal Technology Transfer Act.

52744 (PB–90-263195/XAB) **Bioremediation of petroleum spills in arctic and subarctic environments: A feasibility study. Updated report.** Travis, M.D. Alaska Dept. of Transportation and Public Facilities, Fairbanks, AK (USA). Statewide Research. Jul 1990. 28p. (AK-RD–90-07). Source: NTIS, PC A03/MF A01.

Bioremediation is the process of enhancing indigenous microbes in soil and groundwater to metabolize organic contaminates into harmless by-products. Oil-degrading microorganisms are widely distributed in Alaska's soils. Researchers have biodegraded Prudhoe Bay crude oil in test plots from Barrow to Palmer, Alaska. Bioremediation methods increase soil oxygen and nutrient levels by aeration and fertilization. Soil microbes respond by increasing their activity and population. The larger and more active microbial population utilizes the crude oil as a carbon source and accelerate the degradation of the oil. Polyethylene coverings significantly raise summer soil temperatures. However, special attention must be given to oxygen transport. Hydrogen peroxide injected into soil and groundwater at 100 ppm significantly elevates oxygen levels without detrimental effects to microbes. Fertilizers that utilize inorganic sources of nitrogen and contain N:P:K ratios of 10:1:1 stimulate microbial growth.

52745 (PB–90-264011/XAB) **Laboratory studies evaluating the enhanced biodegradation of weathered crude oil components through the application of nutrients.** Tabak, H.H.; Safferman, S.I.; Venosa, A.D.; Glaser, J.A. Environmental Protection Agency, Cincinnati, OH (USA). Risk Reduction Engineering Lab. Jun 1990. 34p. (EPA–600/D-90/139). Source: NTIS, PC A03/MF A01.

Bench-scale biodegradability studies of the Alaskan weathered crude oil were undertaken as part of the bioremediation project for the shorelines of Prince William Sound, Alaska, contaminated by the Exxon oil spill. The purpose of the studies was to evaluate the capability of the indigenous microbial consortium of the sea water and island beach areas, to biodegrade the weathered crude oil alkane hydrocarbon and polynuclear aromatic (PAH) constituents in batch-type respirometric reactors and shaker flask systems. Biodegradation studies incorporated the use of Inipol EAP 22 as the fertilizer nutrient source. In the respirometric studies, the unpolluted beach material in seawater was spiked with 1,000, 300, and 100 mg/L of weathered crude oil and with Inipol at 5% of oil weight was used in shaker flask studies. Temperature of incubation in both studies was 15 C and culture systems were incubated in darkness. Cumulative oxygen uptake data, growth data and GC/MS analysis data demonstrate almost complete utilization of the alkane hydrocarbon constituents in the presence of Inipol fertilizer and significant biodegradation of the PAH constituents after 6 weeks of incubation.

52746 (PB–90-265950/XAB) **Performance and compatibility analysis of oil weathering and transport-related models for use in the environmental assessment process. Final report.** Coon, M.D.; Knoke, G.S. BDM International, Inc., Seattle, WA (USA). Aug 1990. 61p. (BDM/SEA–90-0024-TR). Source: NTIS, PC A04/MF A01.

OCSEAP has developed and verified a suite of models to study the transport and fate of oil spills in the Alaskan OCS. The objectives of the study are to analyze four specific oil spill models and to recommend modifications allowing their sequential or integrated use in defining the fate of an oil spill. The project consisted of a comprehensive review of the model characteristics and physical

assumptions incorporated into existing models and a study of how they can be effectively combined to support environmental assessment using microcomputers. Redundant model features and missing model features were identified. Various methods for combing the computer codes were compared. A low cost combined code is to develop the I/O software with simple architecture, combine the existing oil spill models in the simplist manner, and prepare a database, without addressing the missing features. The top of the line combined code is to develop menu-driven I/O software, develop a new integrated oil spill model, add code to address the missing features, and to prepare a database.

0220 Transport, Handling, and Storage

Refer also to citation(s) 52736, 53367

03 NATURAL GAS

0302 Reserves, Geology, and Exploration

Refer also to citation(s) 53119

0303 Drilling, Production, and Processing

Refer also to citation(s) 52734, 52756, 53136

0304 Products and By-Products

52747 (DOE/ER/14035–T1) **High pressure heterogeneous catalysis in a low pressure UHV environment: Progress report.** Ceyer, S.T. Massachusetts Inst. of Tech., Cambridge, MA (USA). Dept. of Chemistry. [1990]. 2p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-89ER14035. Order Number DE91001197. Source: NTIS, PC A01/MF A01 - OSTI; GPO Dep.

The major thrust of our research is to carry out for the first time a heterogeneous catalytic reaction that normally is observed only at high pressures (>1 atm) of reactant gas at low pressures ($<10^{-4}$ Torr) in an ultrahigh vacuum environment. The reaction we have chosen is the steam reforming of methane on a Ni(111) crystal.

0306 Economic, Industrial, and Business Aspects

52748 (DOE/EIA–0130(90/07)) **Natural gas monthly, July 1990.** USDOE Energy Information Administration, Washington, DC (USA). Office of Oil and Gas. 3 Oct 1990. 155p. Sponsored by U.S. DOE Energy Information Administration. Order Number DE91000988. Source: NTIS, PC A08/MF A01 - GPO - OSTI; GPO Dep.

This report highlights activities, events, and analyses of interest to public and private sector organizations associated with the natural gas industry. Volume and price data are presented each month for natural gas production, distribution, consumption, and interstate pipeline activities. Producer-related activities and underground storage data are also reported. A glossary is included. 7 figs., 33 tabs.

52749 (DOE/EIA–0131(89)) **Natural Gas Annual 1989.** USDOE Energy Information Administration, Washington, DC (USA). Office of Oil and Gas. 28 Sep 1990. 241p. Sponsored by U.S. DOE Energy Information Administration. Order Number DE91001333. Source: NTIS, PC A11/MF A01 - GPO - OSTI; GPO Dep.

The Natural Gas Annual provides information on the supply and disposition of natural gas to a wide audience including industry, consumers, Federal and State agencies, and educational institutions. The 1989 data are presented in a sequence that follows natural gas (including supplemental supplies) from its production to its end use. Tables summarizing natural gas supply and disposition from 1985 to 1989 are given for each Census division and each state. Annual historical data are shown at the national level. 19 figs., 95 tabs.

0308 Environmental Aspects

Refer also to citation(s) 52741, 52742

0320 Transport, Handling, and Storage

52750 (NRRI–90-14) **Gas storage: Strategy, regulation, and some competitive implications.** Duann, D.J.; Nagler, P.A.; Harunuzzaman, M.; Iyyuni, G. National Regulatory Research Inst., Columbus, OH (USA). Sep 1990. 274p. Sponsored by National Association of Regulatory Utility Commissioners. Source: OSTI; National Regulatory Research Institute, 1080 Carmack Road, Columbus, OH 43210.

The objectives of this study are to provide a close examination of the role of gas storage in the gas delivery system and to suggest storage-related policy alternatives that state regulators can apply to enhance the provision of reliable and economical gas services. Such an examination of gas storage should include an analysis of the basic technical and engineering aspects of storing and moving gas, a review of existing gas stage technology and capacity, an explanation of the benefits and costs associated with the use of storage, and perhaps most important, an analysis of the ways gas storage can facilitate or hinder competition in the gas market. Besides analyzing the role of gas storage in delivering gas, this study will consider the current status of state regulation on gas storage and the regulatory options available to state regulators in enhancing the proper use of storage. Given the emphasis on state regulation, this study is concerned primarily with the storage facilities owned or used by LDCs and end-users. Currently, the majority of storage capacity is owned and operated by interstate pipelines under the regulation of the FERC. It can be expected that with the prevalence of direct gas purchase, more and more LDCs and end-users are likely to use gas storage as a part of their gas procurement strategy to meet future gas requirements. Consequently, the role of state regulation in promoting the proper use of storage definitely will be enhanced. 56 refs., 9 figs., 32 tabs.

0340 Combustion

Refer also to citation(s) 52931, 53168, 53169

04 OIL SHALES AND TAR SANDS

0402 Reserves, Geology, and Exploration

Refer also to citation(s) 52751

0403 Drilling, Fracturing, and Mining

Refer also to citation(s) 52754

52751 **Application of computer blast modeling to oil shale mining.** Hommert, P.J. (Sandia National Labs., Albuquerque, NM (USA)); Preece, D.S.; Thorne, B.J. *Oil Shale Symposium Proceedings (USA),* 22: 44-55 (1989). DOE Contract AC04-76DP00789. (CONF-8904193–: 22. annual oil shale symposium, Golden, CO (USA), 19-20 Apr 1989).

In recent years there has been considerable interest in the development of computer models to describe rock fragmentation by blasting. The interest for this work has come primarily for application to large scale coal or mineral surface mines. However, the basic models developed for these applications are equally applicable for examining typical underground oil shale operations. Models that can predict blasting results starting from first principles can impact room and pillar mining in a number of ways including optimizing round design, control of particle size, evaluation of new explosives, minimizing pillar damage, and developing blasting schemes that can be used in conjunction with continuous miners. In this study, the authors explore how these codes can be used to model the blasting geometry encountered in room and pillar mining operations.

0404 Oil Production, Recovery, and Refining

Refer also to citation(s) 52636

52752 (DOE/LC/11086–2860) **The development of the KENTORT II process for eastern US oil shale: Final report.** Carter, S.D.; Rubel, A.M.; Robl, T.L.; Taulbee, D.N. Kentucky Univ., Lexington, KY (USA). Center for Applied Energy Research. May 1990. 211p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FC21-86LC11086. Order Number DE90009680. Source: NTIS, PC A10/MF A01 - OSTI; GPO Dep.

This report summarizes the development of the KENTORT II process during the period of September 1, 1986 through December 31, 1989. The purpose of this program was to develop on a small scale a process to improve efficiency, process economics, and resolve environmental problems involved in the utilization of eastern US oil shale as an energy source and chemical feedstock. The process includes fluidized bed sections of pyrolysis, gasification, and combustion with combined solid/gas heat transfer among the stages. The operation of each zone of the KENTORT II process was demonstrated both separately in a bench-scale unit and as an integrated system in a 5-lb/hr mini-plant. Sulfur removal of up to 91% was achieved following integral pyrolysis-gasification processing, and no more than 8.3% of the sulfur was converted to SO_2 when the combustion zone was in operation. Carbon gasification proceeded more slowly than sulfur removal, but a significant amount of H_2-rich syngas was produced. Under most conditions, sufficient hydrogen was produced to completely upgrade the crude shale oil. Heat transfer to the pyrolysis zone by solid recirculation was shown to be practical and did not seriously reduce oil yields. Oil yields averaged 111% of modified Fischer assay when the miniplant was operated with solid recirculation and with the combustor in place. This study was successful in experimentally demonstrating the KENTORT II process at a miniature scale, and it is recommended that development of the process continue. Due to the geometry of the KENTORT II design, a commercially realistic heat transfer situation could be not achieved in the 5-lb/hr system. 50 refs., 63 figs., 28 tabs.

52753 (UCID–16986-90-1/2) **Oil shale quarterly report, January–June 1990.** Cena, R. Lawrence Livermore National Lab., CA (USA). 5 Sep 1990. 35p. Sponsored by U.S. DOE Fossil Energy. DOE Contract W-7405-ENG-48. Order Number DE91000497. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This report describes research on oil shale. Above ground retorting, process modeling, and shale oil coking kinetics over oxidized recycle shale are discussed. 13 refs., 13 figs., 12 tabs.

52754 **Water-jet-assisted mechanized oil shale mining factory test.** Kogelmann, W.J. (Alphine Equipment Corp., State College, PA (USA)); Thimons, E.D.; Virgona, J.E.; Weakly, L.A. *Oil Shale Symposium Proceedings (USA),* 22: 56-77 (1989). (CONF-8904193–: 22. annual oil shale symposium, Golden, CO (USA), 19-20 Apr 1989).

This paper presents a study to evaluate the water-jet-assisted (WJA) mechanical cutting of oil shale under actual mining conditions. The physical characteristics of oil shale (a dolomitic limestone containing kerogen) make conventional mechanized production mining methods impractical by causing excessive machine vibration, high bit-wear rates, and excessive dust generation. The successful application of high-pressure water-jet technology in conjunction with mechanical mining could favorably impact the mining of oil shale by reducing capital and operating costs, improving safety, and increasing the extraction ratio of oil shale mined. The WJA roadheader field tests on coal have shown that high-pressure water-jets increase cutter life and reduce ventilation costs by cooling the cutting head, removing already mined rock from the cutting surface, and reducing dust production.

52755 **Oil shale loss from a laboratory fluidized bed.** Taylor, R.W. (Lawrence Livermore National Lab., CA (USA)); Beavers, P.L. *Oil Shale Symposium Proceedings (USA),* 22: 138-148 (1989). DOE Contract W-7405-ENG-48. (CONF-8904193–: 22. annual oil shale symposium, Golden, CO (USA), 19-20 Apr 1989).

The rate of loss of dust from a laboratory-scale fluidized bed of Greenriver oil shale has been measured. The rate of loss of dust form raw shale in the bed was approximately 1%/min for the first few minutes and then decreased. The loss rate for retorted or burnt shale was 5 to 10 times higher. The rates for retorted and burned shale were nearly the same. The time required for a 10 wt% loss of mass was approximately 3 min for processed shale and 1 hour for raw shale. Particles left in the bed during fluidization lost sharp corners, but kept the original elongation. Dust lost by the bed has a very wide range of sizes and demonstrated a strong bimodal distribution of sizes. The bimodal distribution of particles is interpreted as resulting from two mechanisms of dust generation; fracture and wear.

52756 **Isothermal pyrolysis and combustion of oil shale in steam.** Coburn, T.T. (Lawrence Livermore National Lab., CA (USA)); Taylor, R.W.; Morris, C.J. *Oil Shale Symposium Proceedings (USA),* 22: 118-126 (1989). DOE Contract W-7405-ENG-48. (CONF-8904193–: 22. annual oil shale symposium, Golden, CO (USA), 19-20 Apr 1989).

In a solid-recycle retort, the burnt shale that serves as a heat carrier promotes coke formation. Steam inhibits coking reactions and has long been used for this purpose in hydrocarbon crackers. As part of a search for practical methods to minimize oil loss due to coking, the authors have studied steam-moderated flash pyrolysis of Green River and Devonian oil shales. Volatile hydrocarbon production from a laboratory fluidized bed was monitored by using a high-temperature method that largely eliminated extraneous effects due to adsorption/desorption of oil vapors. Kinetics of oil shale flash pyrolysis in steam and in argon were comparable. The oil-plus-gas yield improved by 10 $\pm$ 5% with wet (50% steam) rather than dry fluidizing gas; both raw and carbonate-free (acid-leached) shales have been investigated. The fraction of carbon released by steam gasification of char is shown to be insignificant.

52757 **Kinetic studies on rapid oil shale pyrolysis.** Shen, M.S. (Department of Energy, Morgantown, WV (USA). Morgantown Energy Technology Center); Shadle, L.J.; Zhang, G.Q. *Oil Shale Symposium Proceedings (USA),* 22: 109-117 (1989). (CONF-8904193–: 22. annual oil shale symposium, Golden, CO (USA), 19-20 Apr 1989).

This paper reports oil shale pyrolysis investigated under condition of high-heating rates to obtain a fundamental understanding of the processes influencing oil production and product quality/composition. A 2-inch I.D., laminar-flow entrained reactor (LFER) with gas preheaters was constructed to achieve high particle heating rates. Flow visualization and temperature characterization in the LFER were conducted to provide the data necessary to proceed with a kinetic study on the rapid pyrolysis of oil shale. Calibration curves depicting the flow regimes confirmed that the existing inlet and reactor design can be operated without particle dispersion caused by turbulence. A thermocouple tree was successfully utilized to identify the conditions necessary to match wall and gas temperatures.

52758 **Shear strength of a retorted and combusted oil shale solid waste.** Rothwell, R.A. (Wyoming Univ., Laramie, WY (USA). Dept. of Civil Engineering); Turner, J.P. *Oil Shale Symposium Proceedings (USA),* 22: 227-234 (1989). (CONF-8904193–: 22. annual oil shale symposium, Golden, CO (USA), 19-20 Apr 1989).

The shear strength characteristics of a retorted and combusted Western oil shale are evaluated. Testing consisted of triaxial and unconfined compression tests, including tests in a high-pressure triaxial chamber to simulate high overburden stresses and a program to evaluate the time-dependent cementation of hydrated spent shale. The spent shale is a non-plastic silty sand with an optimum water content of 27 percent and a maximum dry density of 93 pcf (1490 kg/m^3). The effective stress friction angle is 38 degrees with minimal cohesion and the total stress strength parameters are a friction angle of 14 degrees and cohesion of 24 psi (165 kN/m^2). Unconfined compressive strength increased with increased curing time, initial water content, and dry density.

0405 Properties and Composition

52759 (UCRL-ID–106018) **Ion chromatographic analysis of oil shale leachates.** Butler, N.L. Lawrence Livermore National

Lab., CA (USA). 1 Oct 1990. 11p. Sponsored by U.S. DOE Fossil Energy. DOE Contract W-7405-ENG-48. Order Number DE91001055. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

In the present work an investigation of the use of ion chromatography to determine environmentally significant anions present in oil shale leachates was undertaken. Nadkarni et al. have used ion chromatography to separate and quantify halogen, sulfur and nitrogen species in oil shales after combustion in a Parr bomb. Potts and Potas used ion chromatography to monitor inorganic ions in cooling tower wastewater from coal gasification. Wallace and coworkers have used ion chromatography to determine anions encountered in retort wastewaters. The ions of interest in this work were the ions of sulfur oxides including sulfite (SO_3^{2-}), sulfate (SO_4^{2-}), thiosulfate ($S_2O_3^{2-}$), dithionite ($S_2O_4^{2-}$), dithionate ($S_2O_6^{2-}$), peroxyodisulfate ($S_2O_8^{2-}$), and tetrathionate ($S_4O_6^{2-}$), and thiocyanate (SCN^-), sulfide (S^{2-}) hydrosulfide (HS^-), cyanide (CN^-), thiocyanate (SCN^-), and cyanate (OCN^-). A literature search was completed and a leaching procedure developed. 15 refs., 6 figs., 1 tab.

0408 Economic, Industrial, and Business Aspects

Refer also to citation(s) 52754

52760 The future of oil shale. Vawter, R.G. (Western Research Institute, Arlington, VA (US)). *Oil Shale Symposium Proceedings (USA),* 22: 78-84 (1989). (CONF-8904193–: 22. annual oil shale symposium, Golden, CO (USA), 19-20 Apr 1989).

In spite of a growing awareness of the future consequences of rising petroleum imports, oil shale has not become an integral element of federal energy policy. This paper discusses how recent actions by the private sector and regional governments have begun to reverse opinions. First, published estimates by industry have refuted the notion that shale oil will cost $60 to $80 per barrel. Second, state and local governments in the West are supporting planned development. In the early 1980's, there was extreme resistance to the mammoth development proposed at the time. Jobs and economic development are now very important. Third environmental regulations have been adopted which give the private sector and government a better framework from which to interact.

52761 History and some potentials of oil shale cement. Knutson, C.F. (Idaho National Engineering Lab., Idaho Falls, ID (USA)); Smith, R.P.; Russell, B.F. *Oil Shale Symposium Proceedings (USA),* 22: 184-198 (1989). DOE Contract AC07-76ID01570. (CONF-8904193–: 22. annual oil shale symposium, Golden, CO (USA), 19-20 Apr 1989).

The utilization of oil shale as a cement component is discussed. It was investigated in America and Europe during World War I. Additional development occurred in Western Europe, Russia, and China during the 1920s and 1930s. World War II provided further development incentives and a relatively mature technology was in place in Germany, Russia, and China prior to 1980. The utilization of oil shale in cement has taken a number of different paths. One approach has been to utilize the energy in the oil shale as the principal source for the cement plant and to use the combusted shale as a minor constituent of the plant's cement product. A second approach has been to use the combusted shale as a class C or cementitious fly-ash component in portland cement concrete. Other approaches utilizing eastern oil shale have been to use the combusted oil shale with additives as a specialty cement, or to cocombust the oil shale with coal and utilize the sulfur-rich combustion product.

52762 Niche market assessment for a small-scale western oil shale project. Sinor, J.E. (J.E. Sinor Consultants, Inc., Niwot, CO (US)). *Oil Shale Symposium Proceedings (USA),* 22: 207-211 (1989). (CONF-8904193–: 22. annual oil shale symposium, Golden, CO (USA), 19-20 Apr 1989).

The large decline in oil prices which began in 1985 has rendered uneconomic all conventional schemes for producing shale oil as a substitute to petroleum-derived fuels. While continuing advances in production technology may be expected, such advances will be incremental in nature and are unlikely to reduce the cost of production by one half or more, as would be required to be competitive at today's conditions. If all oil shale development is deferred until such time as oil prices increase greatly, it will not be possible to respond to needs for alternative fuels in a timely fashion. It would therefore be extremely beneficial if a self-supporting shale oil facility of any type could be built and operated in the near future. One way in which this might be possible is to build a small-scale facility to manufacture products which are more valuable than fuels. In examining the potential for producing specialty products from oil shale, a marketing assessment was carried out for a small facility which would be located in the western oil shale region. Results are presented.

0409 Waste Management

Refer also to citation(s) 52663, 52758

0410 Environmental Aspects

Refer also to citation(s) 52663, 52755

0420 Legislation and Regulations

Refer also to citation(s) 52754

0440 Combustion

Refer also to citation(s) 52758, 52761

05 NUCLEAR FUELS

0501 Reserves, Exploration, and Mining

Refer also to citation(s) 53348, 53349

52763 (CNIC–00198) **Yeguang granite and uranium metallogeny.** Gong Wenshu (Bureau of Geological Prospection and Exploration of South China, GD (China)). China Nuclear Information Centre, Beijing, BJ (China). Mar 1988. 8p. (In Chinese). (BGPS–0002). Order Number DE91605709. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

The geological, petrologic and geochemical characteristics of rock body of yeguang granite are discussed with emphasis on clarification of occurrence of uranium in rock body and uranium deposit characteristics related to rock body, based on extensive field observations and laboratory test. View points are presented that granite refers to genetic series of terrestial crust transformation tye and uranium deposit is hot water deposit.

52764 (CNIC–00210) **A study on the forms of existence of germanium in uranium-bearing coals of Bangmai basin of Yunnan.** Zhang Shuling (Ministry of Nuclear Industry, Beijing, BJ (China). Beijing Inst. of Uranium Geology); Wang Shuying; Yin Jinshuang. China Nuclear Information Centre, Beijing, BJ (China). Jul 1988. 12p. (In Chinese). (BUGRI–0002). Order Number DE91605710. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

The Bangmai basin is an asymmetrical intermontane synclinal basin with a Hercynian-Yenshan granitic body (γ_3^3-γ_5^2) as its basement. Its overlying strata are made up of the N_1 of coal-bearing clastic rocks of Neogene period. Germanium ore mostly occur within the N_1^2 coal-seam. Uranium, germanium-bearing coals are mainly lignites of low grade in coalation and belong to semidurain, semiclarain, duroclarain and clarodurain. In order to probe into the forms of existence of germanium in coal, six kinds of analytical methods (electronic probe analysis, separation of heavy liquid, grain-size analysis, electric osmosis, chemical extraction and grade-extraction) have been adopted. A simulated test of humic complex germanium in the laboratory was carried out. According to infrared spectral analysis, it is found that 1700 cm^{-1} wavecrest almost disappears, 1250 cm^{-1} peak weakens and 1600 cm^{-1} peak strengthens, 1400 cm^{-1} peak slightly strengthens. No doubt, these illustrate the formatiion of humic germanium complex. Afterward, through differential thermal analysis and measurement of pH variation of media, it futher proves the presence of humic germanium

complex. It is considered that the forms of existence of germanium in uranium-bearing coals mainly are: (1) In close chemical combination with organic matter, usually in the form of humic germanium complex and germanium organic compound; (2) In the state of adsorption, germanium is adsorbed by some organic matter, clay minerals and limonite etc.; (3) A very rare part occurring as isomorphous form.

52765 (CNIC–00297) **Relations between red beds times and uranic mineralization at the area of north-west China, Shaanxi and Inner Mongolia.** Zhou Qiaosheng (Xianyang Research Inst. of Uranic Geology, SN (China)); Quan Zhigao. China Nuclear Information Centre, Beijing, BJ (China). Apr 1989. 16p. (In Chinese). (XYRIUG–0003). Order Number DE91605711. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

Rad beds played an important role in the uranic mineralization. After analyzing the geological evolution in North-West China, Saanxi and Inner Mongolia the red beds is divided into six periods. The evolution rules at each period are studied. The authors found that the time of uranic mineralication and formation of red beds (basin) is simultaneously, the uranic deposits and red beds are accompanying minerals in all places existing deposits. Uranic mineralization is bound up with the continental red beds which was formed under dry and hot climate, but has no relations with the marine red beds. The place where the deposits exist, the red beds must exist, conversely it is not true. In the section, a big uranic deposit is generated only under or above the red beds. The relations between red beds and rich deposit are also explored. The mineralization theory and the model of uranic mineralization in red beds times are presented.

0504 Feed Processing

Refer also to citation(s) 53343

52766 (IPEN-PUB–309) **Development of a reduction process of ammonium uranyl carbonate to uranium dioxide in a fluidized bed.** Gomes, R.P.; Riella, H.G. Instituto de Pesquisas Energeticas e Nucleares (IPEN), Sao Paulo, SP (Brazil). Jul 1990. 21p. (In Portuguese). Order Number DE91605617. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

Laboratory development of ammonium uranyl carbonate (AUC) reduction to uranium dioxide (UO_2) using fluidized bed furnace technique is described. The reaction is carried out at 500-550^{0}C using hydrogen, liberated from cracking of ammonia, as a reducing agent. As the AUC used is obtained from uranium hexafluoride (UF_6) it contains considerable amount of fluoride (approx. 500μg/g) as contaminant. The presence of fluoride leads to high corrosion rates and hence the fluoride concentration is reduced by pyrohydrolisis of UO_2. Physical and Chemical properties of the final product (UO_2) obtained were characterized. (author).

0505 Uranium Enrichment

Refer also to citation(s) 52892, 53194

52767 (CDTN–ASPC.CN-001/89, pp. 39-47) **Semi-annual report of the Enrichment Division from CDTN - July to December 1988.** Campos, J.L. Centro de Desenvolvimento da Tecnologia Nuclear (CDTN), Belo Horizonte, MG (Brazil). 1989. (In Portuguese). In *Semi-annual report of Nuclear Technology and Development Center (CDTN) - July to December 1988.* 353p. Order Number DE91606188. Source: NTIS (US Sales Only), PC A16/MF A01; OSTI; INIS.

The activities developed by the Enrichment Division from CDTN in the area of operation of isotope separation facilities, are described. (E.G.).

52768 (CEA-CONF–10076) **Enrichment: centrifuge process.** Soubbaramayer. CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Physico-Chimie. 1989. 72p. (CONF-8909108–: Seminar on the nuclear fuel cycle, Gif-sur-Yvette (France), 18 Sep - 6 oct 1989). Order Number DE91716208. Source: NTIS (US Sales Only), PC A04/MF A01.

This short course is divided into three sections devoted respectively to the physics of the process, some practical problems raised by the design of a centrifuge and the present situation of centrifugation in the World. 31 figs., 18 refs.

52769 (Risley-Trans–5943) **Development and industrial application of gas centrifuges for the enrichment of uranium in the USSR.** Abbakumov, E.I. (and others). UKAEA Northern Research Labs., Risley (UK). [1989]. 9p. Translation of Atomnaya Energiya (Oct 1989), v. 67(4) p. 255-257. Source: Available from The British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

Translation of Atomnaya Energiya (Oct 1989), v. 67(4) p. 255-257.

The development in the USSR of gas centrifuges for uranium isotope separation was prompted by the need to find an alternative to the earlier gaseous diffusion process which consumed less electrical energy. In the gas centrifuge process, gaseous uranium hexafluoride is contained in a rotor rotating at high speed in a vacuum chamber. The primary separation effect due to the action of centrifugal forces leads to an enrichment in the light molecule $^{235}UF_6$ in the gas near the axis; this separation is multiplied by axial effects. To obtain a sufficiently high level of enrichment, large numbers of gas centrifuges are connected in parallel to form one of about 10 steps in a centrifugal cascade. The development of the technology is reviewed. A reduction of 20 to 30 times in the unit consumption of electricity as compared with the gaseous diffusion method has been achieved. (UK).

0507 Fuels Production and Properties

Refer also to citation(s) 52975, 53038, 53039, 53341

52770 (CEA-R–5525) **Study of new U(VI) and Pu(VI) coprecipitation methods for the preparation of $(U,Pu)O_2$.** Sanoit, J. de. CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Genie Radioactif; Conservatoire National des Arts et Metiers (CNAM), 75 - Paris (France). 1990. 126p. (In French). Order Number DE91716210. Source: NTIS (US Sales Only), PC A07/MF A01.

Two U(VI) and Pu(VI) coprecipitation methods have been studied, for the definition of new processes to prepare $(U,Pu)O_2$ mixed oxides suitable for making MoX fuels or fast breeder reactor fuels. The first system is based on the coprecipitation of a new U(VI), Pu(VI) compound; ammonium uranoplutonate, where as a second system is related to the precipitation of uranyl plutonyl monocarbonate. Experimental conditions to optimize the precipitation and the filtration steps of these two systems have been determined. After calcination under reducing conditions, the mixed oxides obtained are characterized according to different techniques: granulometry, thermogravimetry, solubility in boiling HNO_3 solutions. The properties of such oxides are excellent. The possible processes for preparing $(U, Pu)O_2$ using these new routes are compared with those actually exploited.

0508 Spent Fuels Reprocessing

Refer also to citation(s) 52897, 53381, 53765, 53787

52771 (CEA-CONF–10061) **Actinides complexes in solvent extraction. The amide type of extractants.** Musikas, C.; Condamines, N.; Charbonnel, M.C.; Hubert, H. CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Genie Radioactif. 1989. 2p. (CONF-8909225–: Actinides '89, Tashkent (USSR), 24-29 Sep 1989). Order Number DE91716242. Source: NTIS (US Sales Only), PC A02/MF A01.

The N,N-dialkylamides and the N,N'-tetraalkyl. 2-alkyl 1,3-diamide propane are two promising classes of extractants which could replace advantageously the organophosphorus molecules for the separations of the actinide. The main advantages of the amides lie in their complete incinerability and the small interference of their radiolytic and hydrolytic degradation products for the processes. The actinide extraction chemistry with various amides is reviewed in this paper.

52772 (CEA-CONF–10066) **Solvent distillations studies for a reprocessing plant.** Ginisty, C.; Guillaume, B. CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de

Genie Radioactif. 1989. 16p. (CONF-891013--: 6. symposium on separation science and technology for energy applications, Knoxville, TN (USA), 22-27 Oct 1989). Order Number DE91716206. Source: NTIS (US Sales Only), PC A03/MF A01.

The substantial amounts of solvent used in large reprocessing plants are such that considerable care must be paid to solvent management to limit the production of organic wastes. The installation of intensive treatment by chemical regeneration serves to increase the service life of the solvent. General solvent management, combined with a distillation unit under reduced pressure also helps to recycle the two components of the solvent at a low activity level. Distillation also serves to remove the heavy degradation products that are generally responsible for poor hydraulic behavior and for the holdup of radioactive products such as plutonium, zirconium and ruthenium. From the safety standpoint, the flashpoint of the distilled diluent tends to rise. It can therefore be recycled without risk.

52773 (CEA-R-5519) **A contribution to the study of the extraction of mineral acids and of actinide (IV) and (VI) cations by N,N-dialkylamides.** Condamines, N. CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Genie Radioactif; Paris-6 Univ., 75 (France). Oct 1989. 439p. (In French). Order Number DE91716260. Source: NTIS (US Sales Only), PC A19/MF A01.

N,N-dialkylamides are alternate extractants to tributylphosphate, TBP, for the actinides separation in nuclear fuel reprocessing. N,N-di (2-ethyl hexyl) butyramide and N,N-di (2 ethyl hexyl) isobutyramide are selected for their sufficient extraction and partition ability towards actinides (IV) and (VI) without coextracting fission products. Mechanisms of HNO_3, UO_2^{2+}, Pu^{4+}, Th^{4+} are investigated. Nitric acid extraction is due to the competitive formation of the species $(HNO_3)L_2$, $(HNO_3)L$, $(HNO_3)_2L$ (L: DOBA or DOiBA). An hydrogen bond is the driving force of the transfer. For low acidity media, amides are neutral extractants. Physical interactions, between free ligand and metallic complex, arise for high amide concentrations. Taking into account the non-ideality of the organic medium by a hard spheres mixture model, we estimate that such interactions are far from negligible and very specific to the amide group. Unlike TBP, when increasing acidity, amides behave as anionic extractants. DOBA and DOiBA appear to be satisfactory extractants for fuel reprocessing.

52774 (CNIC--00251) **Behaviour of solvent extraction of niobium in nitric acid.** Lin Cansheng (Academia Sinica, Beijing, BJ (China). Inst. of Atomic Energy); Huang Meixin; Zhang Xianzi; Zhang Chonghai. China Nuclear Information Centre, Beijing, BJ (China). 1988. 17p. (In Chinese). (IAE--0063). Order Number DE91605622. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

The behaviour of solvent extraction of niobium is discussed. The expractants, includding TBP, HDBP, H_2MBP, TBP irradiated, HDEHP, TTA and Aliquat-7402, are used. The special influence of molybdenum and zirconium on solvent extraction of niobium and the extraction behaviur of niobium with TBP irradiated are described. The effect of fluorine and uranium in aqueous phase on extraction of niobium is mentioned. It is observed that the interfacial crud has not relevance to D_{Nb}, but niobium-95 can be absorbed on it. The species of extractable niobium, extraction mechanism, and the reason brought niobum into organic phase are discussed. Finally, the idea of increasing decontamination factor for niobium is suggested.

52775 (CNIC--00252) **Some chemical behaviors of RuNO complexes in the purex process.** Huang Haoxin (Academia Sinica, Beijing, BJ (China). Inst. of Atomic Energy); Zhu Guchui; Hou Shubin; Liu Lanzhen; Yu Yang. China Nuclear Information Centre, Beijing, BJ (China). 1988. 11p. (In Chinese). (IAE--0064). Order Number DE91605623. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

The retention of RuNO complexes in irradiated solvent is small for 30% TBP-kerosene, when TBP and kerosene are not pre-equilibrated with HNO_3 before irradiation. If they are pre-equilibrated with 1 mol/l HNO_3, the retention in kerosene or TBP is small, too, but retention in 30% TBP kerosene is quite large. The ruthenium retention increases with irradiated dose, aging time of loaded organic phase and concentration of pre-equilibrating nitric acid. The irradiated TBP-kerosene is treated by Becker's Method, and Na_2CO_3 extract, H_2O extract and neutral organic phase are collected, respectively. The ruthenium retention is small in H_2O extract phase which could extract and retain ^{95}Zr strongly. But the ruthenium retention in neutral phase is large. The experiments indicate that the compounds which retain Ru could be the degradation products of kerosene instead of TBP. The Ru retention in 30% TBP-kerosene-laurohydroxamic acid is obvious; and it increases with the concentration of hydroxamic acid, aging temperature and itme of loaded organic phase. If the uranium in the aqueous phase is above than 30 mg/ml, the Ru retention in the above system will not be influenced by $NaNO_2$, although $NaNO_2$ can destroy the hydroxamic acid.

52776 (FRNC-TH--3663) **Numerical modelling and object-oriented simulation of a fuel reprocessing plant.** Mardon, D. Bordeaux-1 Univ., 33 (France). 1989. 249p. (In French). Order Number DE91716207. Source: NTIS (US Sales Only), PC A11/MF A01.

This document describes of software of continued simulation applied to the chemical process of the reprocessing plant in La Hague. This software deals with object-oriented programming. The industrial software concerning simulation in Process Engineering and the general requirements of users in this field are studied. It is thought that object-oriented programming meet some of these requirements. Yet mathematical studies of models and numerical methods remain necessary. Furthermore, Software Engineering methods, recently developed in this area, does not solve all the design problems encountered in the field of scientific software. A new mathematical model of a Uranium extractor is presented. It consists of a hyperbolic semi-linear system for which an original numerical scheme has been developed. Its convergence is demonstrated. This scheme conserves positivity for the convection and the reaction part, independently of a condition caried by the second member of the equation. A bibliographical study indicated us the numerical methods to employ in Process Engineering whereas a methodological study of object oriented design implied the construction of a simulator. The architecture of this simulator is outlined. The presented results allow us to evaluate the approach utilised.

52777 (ORNL/TM--11466) **Evaluation of conceptual flowsheets for incorporating Light Water Reactor (LWR) fuel materials in an advanced nuclear fuel cycle.** Bell, J.T.; Burch, W.D.; Collins, E.D.; Forsberg, C.W.; Prince, B.E.; Bond, W.D.; Campbell, D.O.; Delene, J.G.; Mailen, J.C. Oak Ridge National Lab., TN (USA). Aug 1990. 45p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC05-84OR21400. Order Number DE91000938. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

A preliminary study by a group of experts at ORNL has generated and evaluated a number of aqueous and non-aqueous flowsheets for recovering transuranium actinides from LWR fuel for use as fuel in an LMR and, at the same time, for transmutation of the wastes to less hazardous materials. The need for proliferation resistance was a consideration in the flowsheets. The current state of development of the flowsheets was evaluated and recommendations for additional study were made. 3 refs., 6 figs.

0509 Transport, Handling, and Storage

Refer also to citation(s) 52788, 52799, 52870, 53412

52778 (EPRI-NP--6941) **NUTECH HOrizontal MOdular Storage (NUHOMS) modular spent-fuel storage system: Performance testing: Final report.** Strope, L.A. (Pacific Northwest Lab., Richland, WA (USA)); McKinnon, M.A.; Dyksterhouse, D.J.; McLean, J.C. Electric Power Research Inst., Palo Alto, CA (USA); Pacific Northwest Lab., Richland, WA (USA); Carolina Power and Light Co., Raleigh, NC (USA). ©Sep 1990. 120p. Sponsored by Electric Power Research Institute. DOE Contract AC06-76RL01830. (PNL--7327). Source: Research Reports Center, Box 50490, Palo Alto, CA 94303.

This report documents the results of a heat transfer and shielding performance evaluation of the NUTECH HOrizontal MOdular

Storage (NUHOMS®) System utilized by the Carolina Power and Light Co. (CP&L) in an Independent Spent Fuel Storage Installation (ISFSI) licensed by the US Nuclear Regulatory Commission (NRC). The ISFSI is located at CP&L's H. B. Robinson Nuclear Plant (HBR) near Hartsville, South Carolina. The demonstration included testing of three modules, first with electric heaters and then with spent fuel. The results indicated that the system was conservatively designed, with all heat transfer and shielding design criteria easily met. 5 refs., 45 figs., 9 tabs.

52779 (ISPO–325) **Feasibility study on the verification of fresh fuel assemblies in shipping containers.** Swinth, K.L.; Tanner, J.E. Pacific Northwest Lab., Richland, WA (USA). Sep 1990. 48p. Sponsored by U.S. DOE Environment Health & Safety. DOE Contract AC06-76RL01830. (PNL–7466). Order Number DE91001039. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The purpose of this study was to examine the feasibility of using various nondestructive measurement techniques to determine the presence of fuel assemblies inside shipping containers and to examine the feasibility of measuring the fissile content of the containers. Passive and active techniques based on both gamma and neutron assay were examined. In addition, some experiments and calculations were performed to evaluate neutron techniques. Passive counting of the 186 keV gamma from ^{235}U is recommended for use as an attributes measurement technique. Experiments and studies indicated that a bismuth germanate (BGO) scintillator is the preferred detector. A properly designed system based on this detector will provide a compact detector that can selectively verify fuel assemblies within a shipping container while the container is in a stack of similarly loaded containers. Missing fuel assemblies will be readily detected, but gamma counting of assemblies cannot detect changes in the fissile content of the inner rods in an assembly. If a variables technique is required, it is recommended that more extensive calculations be performed and removal of the outer shipping container be considered. Marking (sealing) of the assemblies with a uniquely identifiable transponder was also considered. This would require the development of procedures that would assure proper application and removal of the seal. When change to a metal outer container occurs, the technique will no longer be useful unless a radiolucent window is included in the container. 20 refs., 7 figs., 2 tabs.

52780 (SAND–88-0506C) **The development of an international standard problem set for thermal code evaluation.** Glass, R.E. Sandia National Labs., Albuquerque, NM (USA). [1988]. 19p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-880201–46: Waste management '88: symposium on radioactive waste management, Tucson, AZ (USA), 28 Feb - 3 mar 1988). Order Number DE91001263. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

During a preparatory meeting in Paris on June 21–22, 1979, interest was expressed by most Nuclear Energy Agency (NEA) member countries in exchanging information and experience on various aspects of spent fuel transportation. The result of this meeting was the establishment of working groups under the auspices of the Committee on Reactor Physics (CRP) in the areas of heat transfer, criticality, and shielding. The heat transfer group was established to define a set of cask-like thermal problems and to provide solutions. The problems set and its solutions are available to benchmark computer codes. 14 figs., 1 tab.

52781 (SAND–89-0017) **A robotic system to conduct radiation and contamination surveys on nuclear waste transport casks.** Harrigan, R.W.; Sanders, T.L. Sandia National Labs., Albuquerque, NM (USA). Jun 1990. 129p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC04-76DP00789. (TTC–0883). Order Number DE91001045. Source: NTIS, PC A07/MF A01; OSTI; INIS; GPO Dep.

The feasibility of performing, numerous spent fuel cask operations using fully integrated robotic systems is under evaluation. Using existing technology, operational and descriptive software and hardware in the form of robotic end effectors are being designed in conjunction with interfacing cask components. A robotic radiation and contamination survey system has been developed and used on mock-up cask hardware to evaluate the impact of such fully automated operations on cask design features and productivity. Based on experience gained from the survey system, numerous health physics operations can be reliably performed with little human intervention using a fully automated system. Such operations can also significantly reduce time requirements for cask-receiving operations. 7 refs., 51 figs., 6 tabs.

52782 (WHC-SA–0934) **Remote handling equipment for removal of waste from single-shell tanks at the Hanford Site.** Jenkins, W.W. Westinghouse Hanford Co., Richland, WA (USA). Sep 1990. 7p. Sponsored by U.S. DOE Office of Environmental Restoration and Waste Management. DOE Contract AC06-87RL10930. (CONF-901101–39: American Nuclear Society winter meeting, Washington, DC (USA), 11-15 Nov 1990). Order Number DE91001282. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

Mechanical retrieval equipment concepts are being developed for remote 'mining' of the radioactive waste in underground storage tanks at the Hanford Site in Washington State. This paper presents a description of the tanks, the waste, the key design considerations, and some of the more promising concepts for mechanical waste retrieval. 6 refs., 4 figs.

52783 (WHC-SA–0935) **Selected in-tank property measurement methods for Hanford Site single-shell tanks.** Morris, K.L.H.; Shattuck, A.F.; Covert, W.A. Westinghouse Hanford Co., Richland, WA (USA). Sep 1990. 6p. Sponsored by U.S. DOE Office of Environmental Restoration and Waste Management. DOE Contract AC06-87RL10930. (CONF-901101–40: American Nuclear Society winter meeting, Washington, DC (USA), 11-15 Nov 1990). Order Number DE91001283. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

The Westinghouse Hanford Company operates the Hanford Site in Washington State for the US Department of Energy. As part of an agreement between the US Department of Energy, the US Environmental Protection Agency, and the Washington State Department of Ecology, Westinghouse Hanford Company has undertaken to clean up the underground tanks located on the Site. These tanks store various radioactive and hazardous wastes produced from chemical processes to refine spent nuclear fuel into defense materials. As part of the cleanup process, equipment must be developed to remove the waste. To design this equipment, the waste must be characterized by its mechanical properties and simulated waste must be made to emulate these properties for equipment testing. A survey of available remote (in-tank) and laboratory techniques was undertaken and the resulting plan to gather all the necessary information involves a three-step approach: laboratory measurements, laboratory measurements on historical synthetic waste mixtures, and in-tank measurements. A list of mechanical properties to be gathered is also included. 3 refs., 3 figs., 2 tabs.

52784 **Non-destructive identification of unidentified radioactive materials using multiple data inputs.** Mihalovich, G.S. (Westinghouse Materials Co. of Ohio, Cincinnati, OH (USA)). pp. 337-341 of Waste processing, transportation, storage and disposal, technical programs and public education: Volume 2. Low-level waste. Post, R.G. Arizona Board of Regents, Tucson, AZ (USA) (1989). pp. 844 (CONF-890207–: Waste management '89: 15th international waste management symposium conference, Tucson, AZ (USA), 26 Feb - 2 mar 1989).

The Feed Materials Production Center (FMPC), is a Department of Energy (DOE) facility, that produces high purity uranium for defense programs. It also serves as the DOE's repository for temporary storage of thorium materials. The containers storing the thorium materials have suffered from extensive environmental deterioration and with the passing of time records have been lost. The net result is that a significant number of containers have lost their identifying markings. The exact type of materials in some of the containers is unknown. The containers must be repackaged for Environmental Safety and Health (ES and H) reasons. Prior to repackaging the identity of the contents must be ascertained. However, these containers can not be opened due to as low as reasonably achievable (ALARA) and ES and H considerations. This paper presents a method developed to determine the content of the containers, without physical inspection, prior to the repackaging/overpacking. This method utilizes a computer based data base

management system which incorporates statistical analysis of the available input data and assigns statistical weighing to the various inputs, based on the significance of the data.

52785 **Measuring and predicting gamma radiation from radioactive glass-filled canisters.** Peters, R.D. (Pacific Northwest Lab., Richland, WA (US)); Jenquin, U.P.; Holton, L.K. *Nuclear Technology (USA)*, 90(1): 78-86 (Apr 1990). DOE Contract AC06-76RL01830.

Measurement and prediction of outside surface exposure rates and measurement of gamma photon spectra from radioactive sources are described. The sources were 30-cm-diam canisters filled with borosilicate glass to a height of ~ 100 cm. Each canister contained up to 237 kCi of ^{137}Cs and 159 kCi of ^{90}Sr. Exposure rates on the outside surfaces ranged from 26000 to 320000 R/h chiefly from decay of ^{137}Cs.

0520 Waste Management

Refer also to citation(s) 52778, 52781, 52785, 52893, 52899, 53103, 53342, 53401, 53408, 53588, 53836, 53867, 53868, 53872, 53873, 53874, 53875

52786 (AEEW-R–2398) **Advanced cementation concepts: Final report.** Howard, C.G. UKAEA Atomic Energy Establishment, Winfrith (UK). Chemistry Div. Oct 1989. 75p. (CPDG–88-P-112). Order Number DE91606143. Source: NTIS (US Sales Only), PC A04/MF A01; OSTI; INIS.

The purpose of this programme of work was to investigate whether improvements could be made to existing formulations for cement suitable for the immobilization of intermediate level radioactive waste. Two additives were selected, microsilica and limestone flour. Improvements to the cement were only slight. (author).

52787 (AERE-R–13312) **The equilibrium leach testing of cemented MTR waste forms.** Brown, P.E.; Inns, A.J.; Lindsay, M. UKAEA Harwell Lab. (UK). Chemistry Div. Apr 1990. 31p. Contract PECD 7/9/206-30/84. (DOE-RW–90.002). Source: Available from H.M. Stationery Office, London, Price Pound 10.00.

The equilibrium source term of cemented waste forms developed for the immobilization of waste arising from the reprocessing of Material Test Reactor (MTR) fuel has been evaluated using simulant and actual raffinate materials. Simulant waste forms made from fully active Windscale Advanced Gas-Cooled Reactor (WAGR) fuel materials immobilised in cement formulations have been compared with actual raffinate materials, produced at Dounreay, and immobilised in a similar fashion. The low concentrations of long-lived radionuclides in the leachates have demonstrated that their retention within the repository is achievable. ^{241}Am and curium isotopes may require further examination under repository conditions. (author).

52788 (BfS-ET–1/90) **Amount of radioactive wastes in the Federal Republic of Germany - waste inquiry for the year 1989.** Brennecke, P.; Schumacher, J. Bundesamt fuer Strahlenschutz, Braunschweig (Germany, F.R.). Fachbereich Nukleare. Apr 1990. 53p. (In German). Order Number DE91717057. Source: NTIS (US Sales Only), PC A04/MF A01.

On December 31, 1989, the unconditioned radioactive wastes amounted to about 13,000 m^3 including a share of about 1,300 m^3 of waste stored for decay. The volume of the conditioned radioactive wastes amounted to about 44,400 m^3. Of this, the waste from nuclear research establishments made up about 18,100 m^3, the waste from the operation of nuclear power plants about 13,800 m^3 and that from the reprocessing of spent fuel elements about 9,000 m^3. A prognosis was also made of the future amount of conditioned radioactive wastes. According to this forecast, supplementing the 1989 radioactive waste inquiry, the cumulated waste package volume of radioactive wastes with negligible heat generation will be approximately within the bandwidth of 129,900 m^3 to 170,900 m^3 at the end of the year 2000, whereas for heat-generating radioactive wastes a bandwidth of 3,200 m^3 to 3,600 m^3 is estimated. In 1989 a capacity of about 124,400 m^3 for the interim storage of radioactive wastes was available in the Federal Republic of Germany. On December 31, 1989, an average of about 40% of this capacity was utilized by unconditioned and conditioned radioactive wastes. From the data on the expected amount of radioactive wastes and on the utilization factor of the interim storage facilities, it may be concluded that, taking an overall view, no bottlenecks in the interim storage of radioactive wastes with negligible heat generation are to be anticipated up to the planned operation of the Konrad repository in the mid-nineties. (orig./HP).

52789 (BfS-ET–6/90) **The Konrad mine - the planned German repository for radioactive waste with negligible heat generation.** Berg, H.P.; Brennecke, P. Bundesamt fuer Strahlenschutz, Braunschweig (Germany, F.R.). Fachbereich Nukleare. Jul 1990. 78p. Order Number DE91717056. Source: NTIS (US Sales Only), PC A05/MF A01.

This report deals with the planned Konrad repository and describes the current state of affairs. In particular, the technical concept is explained and a survey of the radioactive waste intended for disposal is given. The safety assessments which have been made, including the derivation of preliminary waste acceptance requirements, are described and the principles of the waste package control are outlined. (orig./HP).

52790 (BMI/OWTD–5) **FRACFLO: Analytical solutions for two-dimensional transport of a decaying species in a discrete planar fracture and equidistant multiple parallel fractures with rock matrix diffusion.** Gureghian, A.B. Battelle Memorial Inst., Willowbrook, IL (USA). Office of Waste Technology Development. Jul 1990. 244p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC02-83CH10139. Order Number DE91000089. Source: NTIS, PC E10/MF E01 - OSTI; GPO Dep.

This report contains 1 microfiche supplement.

Analytical solutions based on the Laplace and Fourier transformation techniques are derived for the transient advective-dispersive transport of a single radionuclide through fractures (two-dimensional analysis) and rock (one-dimensional analysis). The longitudinal dispersion-free solution is also reported. The geometry considered consists of either a single planar fracture (infinite diffusion in the rock) or a system of equidistant parallel fracture planes with uniform aperture (finite diffusion in the rock). The solution assumes that the ground-water flow regime is under steady-state and isothermal conditions, and the streamlines along the direction of flow are parallel. The solution related to the single fracture case was verified by comparing its performance with available results from other works. Two sets of solutions were derived for the multiple parallel fracture case; the first, based on a series approximation, and the second, based on contour integration, were designed to cope efficiently with small and large Fourier numbers, respectively. The general solution requires, in both cases, the evaluation of a single integral, except in the case of the solution based on contour integration, where an additional one is required. This is performed using a Gauss-Legendre quadrature scheme. 34 refs., 65 figs., 77 tabs.

52791 (BMI/OWTD–7) **Large block migration experiments: INTRAVAL phase 1, Test Case 9.** Gureghian, A.B. (Battelle, Willowbrook, IL (USA). Office of Waste Technology Development); Noronha, C.J.; Vandergraaf, T.T. Battelle, Willowbrook, IL (USA). Office of Waste Technology Development. Aug 1990. 47p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC02-83CH10139. Order Number DE91000670. Source: NTIS, PC A04/MF A01 - OSTI; GPO Dep.

The development of INTRAVAL Test Case 9, as presented in this report, was made possible by a past subsidiary agreement to the bilateral cooperative agreement between the US Department of Energy (DOE) and Atomic Energy of Canada Limited (AECL) encompassing various aspects of nuclear waste disposal research. The experimental aspect of this test case, which included a series of laboratory experiments designed to quantify the migration of tracers in a single, natural fracture, was undertaken by AECL. The numerical simulation of the results of these experiments was performed by the Battelle Office of Waste Technology Development (OWTD) by calibrating an in-house analytical code, FRACFLO, which is capable of predicting radionuclide transport in an idealized fractured rock. Three tracer migration experiments were performed, using nonsorbing uranine dye for two of them and sorbing Cs-137 for the third. In addition, separate batch experiments were performed to determine the fracture surface and rock matrix sorption

coefficients for Cs-137. The two uranine tracer migration experiment were used to calculate the average fracture aperture and to calibrate the model for the fracture dispersivity and matrix diffusion coefficient. The predictive capability of the model was then tested by simulating the third, Cs-137, tracer test without changing the parameter values determined from the other experiments. Breakthrough curves of both the experimental and numerical results obtained at the outlet face of the fracture are presented for each experiment. The reported spatial concentration profiles for the rock matrix are based solely on numerical predictions. 22 refs., 12 figs., 8 tabs.

52792 (BMI/OWTD–8) **FRACVAL: Validation (nonlinear least squares method) of the solution of one-dimensional transport of decaying species in a discrete planar fracture with rock matrix diffusion: Part 1, Analytical solutions.** Gureghian, A.B. Battelle, Willowbrook, IL (USA). Office of Waste Technology Development. Aug 1990. 79p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC02-83CH10139. Order Number DE91000671. Source: NTIS, PC A05/MF A01 - OSTI; GPO Dep.

Analytical solutions based on the Laplace transforms are presented for the one-dimensional, transient, advective-dispersive transport of a reacting radionuclide through a discrete planar fracture with constant aperture subject to diffusion in the surrounding rock matrix where both regions of solute migration display residual concentrations. The dispersion-free solutions, which are of closed form, are also reported. The solution assumes that the groundwater flow regime is under steady-state and isothermal conditions and that the rock matrix is homogeneous, isotropic, and saturated with stagnant water. The verification of the solution was performed by means of related analytical solutions dealing with particular aspects of the transport problem under investigation on the one hand, and a numerical solution capable of handling the complete problem on the other. The integrals encountered in the general solution are evaluated by means of a composite Gauss-Legendre quadrature scheme. 9 refs., 8 figs., 32 tabs.

52793 (BMU–1990-264) **Investigations on the recycling of non-ferrous metals.** Schriftenreihe Reaktorsicherheit und Strahlenschutz. Ergebnisberichte, Untersuchungen, Studien, Gutachten. Goertz, R.; Graf, R.; Knaup, A.G. Brenk Systemplanung Ingenieurbuero fuer Wissenschaftlich-Technischen Umweltschutz, Aachen (Germany, F.R.); Bundesministerium fuer Umwelt-, Naturschutz und Reaktorsicherheit, Bonn (Germany, F.R.). Mar 1990. 277p. (In German). Contract BMU St.Sch. 1031. Source: Available from GRM Werbeberatung - Werbemittlung - PR, Eggenstein-Leopoldshafen, (Germany, F.R.).

During repair and decommissioning in the nuclear facilities in the Federal Republic of Germany non-ferrous metal scrap arises, which can potentially be reused without harmful effects by release as ordinary scrap. The materials are aluminum, copper, copper alloys and lead. Purpose of the investigation was to examine the applicability of the recycling concepts recommended in October 1987 by the Commission for Radiological Protection for steel scrap from nuclear power plants to non-ferrous scrap. Therefore as clearance levels for release for general melting 1 Bq/g for specific activity and the contamination limits from Appendix IX column 4 of the Radiological Protection Ordinance (0.37 Bq/cm^2 for β, γ-emitters) have been assumed. The consideration is restricted to practically α-free scrap. The dose distribution above 3 μSv/a is dominated by external irradiation by photons. The results do not substantially differ from those obtained before for steel scrap. Only for aluminium there is an enhanced number of exposed persons per Mg of released scrap as compared to steel, which is due to the fact that with the same scrap geometry and contamination the specific activity of the light metal will be higher. Under consideration of the scrap arisings, however, it can be concluded, that there are only a few persons exposed above 10 μSv/a. (orig./HP).

52794 (BNL–45163) **Comparison of modified sulfur cement and hydraulic cement for encapsulation of radioactive and mixed wastes.** Kalb, P.D.; Heiser, J.H. III; Colombo, P. Brookhaven National Lab., Upton, NY (USA). [1990]. 13p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC02-76CH00016. (CONF-9008119–2: 12. annual DOE low level waste management conference, Chicago, IL (USA), 28-29 Aug 1990). Order Number DE91001130. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The majority of solidification/stabilization systems for low-level radioactive waste (LLW) and mixed waste, both in the commercial sector and at Department of Energy (DOE) facilities, utilize hydraulic cement (such as portland cement) to encapsulate waste materials and yield a monolithic solid waste form for disposal. A new and innovative process utilizing modified sulfur cement developed by the US Bureau of Mines has been applied at Brookhaven National Laboratory (BNL) for the encapsulation of many of these "problem" wastes. Modified sulfur cement is a thermoplastic material, and as such, it can be heated above it's melting point (120°C), combined with dry waste products to form a homogeneous mixture, and cooled to form a monolithic solid product. Under sponsorship of the DOE, research and development efforts at BNL have successfully applied the modified sulfur cement process for treatment of a range of LLWs including sodium sulfate salts, boric acid salts, and incinerator bottom ash and for mixed waste contaminated incinerator fly ash. Process development studies were conducted to determine optimal waste loadings for each waste type. Property evaluation studies were conducted to test waste form behavior under disposal conditions by applying relevant performance testing criteria established by the Nuclear Regulatory Commission (for LLW) and the Environmental Protection Agency (for hazardous wastes). Based on both processing and performance considerations, significantly greater waste loadings were achieved using modified sulfur cement when compared with hydraulic cement. Technology demonstration of the modified sulfur cement encapsulation system using production-scale equipment is scheduled for FY 1991. 12 refs., 8 figs., 3 tabs.

52795 (BNL–45231) **A data base for low-level radioactive waste disposal sites.** Daum, M.L.; Moskowitz, P.D. Brookhaven National Lab., Upton, NY (USA). Jul 1989. 52p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC02-76CH00016. Order Number DE91001245. Source: NTIS, PC A04/MF A01; OSTI; INIS; GPO Dep.

A computerized database was developed to assist the US Environmental Protection Agency (EPA) in evaluating methods and data for characterizing health hazards associated with land and ocean disposal options for low-level radioactive wastes. The data cover 1984 to 1987. The types of sites considered include Nuclear Regulatory Commission (NRC) licensed commercial disposal sites, EPA National Priority List (NPL) sites, US Department of Energy (DOE) Formerly Utilized Sites Remedial Action Project (FUSRAP) and DOE Surplus Facilities Management Program (SFMP) sites, inactive US ocean disposal sites, and DOE/Department of Defense facilities. Sources of information include reports from EPA, the US Department of Energy (DOE) and the Nuclear Regulatory Commission (NRC), as well as direct communication with individuals associated with specific programs. The data include site descriptions, waste volumes and activity levels, and physical and radiological characterization of low-level wastes. Additional information on mixed waste, packaging forms, and disposal methods were compiled, but are not yet included in the database. 55 refs., 4 figs., 2 tabs.

52796 (CDTN–ASPC.CN-001/89, pp. 105-123) **Semi-annual report of the radioactive waste project in CDTN - July to December 1988.** Miaw, S.T.W. Centro de Desenvolvimento da Tecnologia Nuclear (CDTN), Belo Horizonte, MG (Brazil). 1989. (In Portuguese). In *Semi-annual report of Nuclear Technology and Development Center (CDTN) - July to December 1988.* 353p. Order Number DE91606188. Source: NTIS (US Sales Only), PC A16/MF A01; OSTI; INIS.

The main activities of R and D developed at CDTN in the radioactive waste area, aiming to develop waste treatment process and to qualify the products from this treatment are described. (E.G.).

52797 (CEA-CONF–10067) **Malonamides as new extractants for nuclear waste solutions.** Cuillerdier, C.; Musikas, C.; Hoel, P.; Nigond, L.; Vitart, X. CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Genie Radioactif. 1989. 16p. (CONF-891013–: 6. symposium on separation science and technology for energy applications, Knoxville, TN (USA), 22-27

Oct 1989). Order Number DE91716392. Source: NTIS (US Sales Only), PC A03/MF A01.

Substituted malonamides are able to extract α emitters from radioactive solutions in nitric acid, all the actinides (III, IV, VI) are well extracted and can be easily back extracted. Some problems remain with neptunium and technetium. These solvents are not expensive. For an industrial purpose, synthesis has been optimized, and a proper choice of commercial basic products can decrease the cost. The solvent obtained on a pilot scale (1 kg) was found to be pure enough, it didn't need any additional treatment. Degradation under hydrolysis or radiolysis is not important in the conditions of practical experiment ($t < 40^0C$). Degradation products can be washed with NaOH (carboxylic acids) they don't give precipitates or emulsions. Efficiency of the solvent is good compared to CMPO, taking into account the lack of extensive industrial development. Further researches are undertaken in two main directions: optimizing the synthesis and use of aliphatic diluents.

52798 (CEA-R-5526) **Treatment of plutonium contamined solid wastes by electrogenerated Ag(II).** Saulze, J.L. CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Genie Radioactif; Conservatoire National des Arts et Metiers (CNAM), 75 - Paris (France). 1990. 119p. (In French). Order Number DE91716209. Source: NTIS (US Sales Only), PC A06/MF A01.

A process for the treatment of plutonium contaminated solid wastes is designed. Two types of wastes have been studied; incineration ashes (COGEMA UP1) and sludges produced in the cryotreatment facility in Cadarache Center (France). The principle of the process is based on the rapid dissolution of PuO_2 (contained in the wastes) under the action of aggressive Ag(II) species, regenerated electrochemically. In the case of the treatment of incinerator ashes an electrochemical pretreatment is necessary if the chloride ion content of the ashes is high. The feasibility of the decontamination process has been proved for the two types of plutonium contaminated solid wastes at a pilot level; for example 1 Kg of ashes (or 0.75 Kg of sludges) has been treated in one experiment, and 97% (or 95%) of the total plutonium was dissolved at the end of the experiment. Industrial applications of this new process are underway.

52799 (DOE/EA-0315) **Management activities for retrieved and newly generated transuranic waste, Savannah River Plant.** USDOE Assistant Secretary for Defense Programs, Washington, DC (USA). Aug 1988. 38p. Sponsored by U.S. DOE Defense Programs. Order Number DE91000842. Source: NTIS, PC A04/MF A01 - OSTI; GPO Dep.

The purpose of this Environmental Assessment (EA) is to assess the potential environmental impacts of the retrieval and processing of retrieved and newly generated transuranic (TRU) radioactive waste at the Savannah River Plant (SRP), including the transportation of the processes TRU waste to the Waste Isolation Pilot Plant (WIPP) near Carlsbad, New Mexico. A new TRU Waste Facility (TWF) will be constructed at SRP to retrieve and process the SRP TRU waste in interim storage to meet WIPP criteria. This EA has been prepared in compliance with the National Environmental Policy Act (NEPA) of 1969, as amended, and the requirements of the Council of Environmental Quality Regulations for implementing NEPA (40 CFR Parts 1500-1508). The National Environmental Policy Act (NEPA) requires the assessment of environmental consequences of all major federal actions that may affect the quality of the human environment. This document describes the environmental impact of constructing and operating the TWF facility for processing and shipment of the TRU waste to WIPP and considers alternatives to the proposed action. 40 refs., 12 figs., 12 tabs.

52800 (DOE/LLW-67T) **Site characterization handbook.** Golder Associates, Inc., Redmond, WA (USA); Weston (Roy F.), Inc., Seattle, WA (USA). Jun 1988. 430p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC07-76ID01570. Order Number DE91000751. Source: NTIS, PC A19/MF A01 - OSTI; GPO Dep.

This Handbook discusses both management and technical elements that should be considered in developing a comprehensive site characterization program. Management elements typical of any project of a comparable magnitude and complexity are combined with a discussion of strategies specific to site characterization. Information specific to the technical elements involved in site characterization is based on guidance published by the Nuclear Regulatory Commission (NRC) with respect to licensing requirements for LLW disposal facilities. The objective of this Handbook is to provide a reference for both NRC Agreement States and non-Agreement States for use in developing a comprehensive site characterization program that meets the specific objectives of the State and/or site developer/licensee. Each site characterization program will vary depending on the objectives, licensing requirements, schedules/budgets, physical characteristics of the site, proposed facility design, and the specific concerns raised by government agencies and the public. Therefore, the Handbook is not a prescriptive guide to site characterization. 18 refs., 6 figs.

52801 (K/QT-382) **Performance testing of grout-based waste forms for the solidification of anion exchange resins.** Morgan, I.L.; Bostick, W.D. Oak Ridge National Lab., TN (USA). Oct 1990. 18p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC05-84OT21400. Order Number DE91001314. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The solidification of spent ion exchanges resins in a grout matrix as a means of disposing of spent organic resins produced in the nuclear fuel cycle has many advantages in terms of process simplicity and economy, but associated with the process is the potential for water/cement/resins to interact and degrade the integrity of the waste form solidified. Described in this paper is one possible solution to preserving the integrity of these solidified waste forms: the encapsulation of beaded anion exchange resins in grout formulations containing ground granulated blast furnace slag, Type I-II (mixed) portland cement, and additives (clays, amorphous silica, silica fume, and fly ash). The results of the study reported herein show the cured waste form tested has a low leach rate for nitrate ion from the resin (and a low leach rate is inferred for Tc-99) and acceptable durability as assessed by the water immersion and freezing/thawing test protocols. The results also suggest a tested surrogate waste form prepared in vinyl ester styrene binder performs satisfactorily against the wetting/drying criterion, and it should offer additional insight into future work on the solidification of spent organic resins. 26 refs., 4 figs., 5 tabs.

52802 (MIC-90-04406/XAB) **Optimization in the decommissioning of uranium tailings: A report. Research report No. INFO-0321.** MacLaren Plansearch, Inc., Ottawa, ON (Canada). ©1987. 350p. Source: NTIS, PC EE17/MF E01.

Detailed examination of the problem of choosing the optimal decommissioning approach for uranium and mill tailings sites. Various decision methods are discussed and evaluated, and their application in similar decision problems are summarized. The report includes, by means of a demonstration, a step-by-step guide to how cost-benefit, cost-effectiveness, multi-attribute utility theory and decision system techniques can be applied to a decommissioning problem. The strengths and weaknesses of the various methods are highlighted.

52803 (NUREG-1383) **Guidance on the application of quality assurance for characterizing a low-level radioactive waste disposal site: Final report.** Pittiglio, C.L. Jr.; Starmer, R.J.; Hedges, D. Nuclear Regulatory Commission, Washington, DC (USA). Div. of Low-Level Waste Management and Decommissioning. Oct 1990. 13p. Sponsored by Nuclear Regulatory Commission. Source: NTIS, PC A03/MF A01 - GPO; OSTI; INIS.

This document provides the Nuclear Regulatory Commission's staff guidance to an applicant on meeting the quality control (QC) requirements of Title 10 of the Code of Federal Regulations, Part 61, Section 61.12 (10 CFR 61.12), for a low-level waste disposal facility. The QC requirements combined with the requirements for managerial controls and audits are the basis for developing a quality assurance (QA) program and for the guidance provided herein. QA guidance is specified for site characterization activities necessary to meet the performance objectives of 10 CFR Part 61 and to limit exposure to or the release of radioactivity. 1 tab.

52804 (NUREG-1423-Vol.1) **A compilation of reports of The Advisory Committee on Nuclear Waste, July 1988-June 1990: Volume 1.** Nuclear Regulatory Commission, Washington, DC (USA). Advisory Committee on Nuclear Waste. Aug 1990. 107p.

Sponsored by Nuclear Regulatory Commission. Source: NTIS, PC A06/MF A01 - GPO - OSTI.

This compilation contains 37 reports issued by the Advisory Committee on Nuclear Waste (ACNW) during the first two years of its operation. The reports were submitted to the Chairman or to the Executive Director for Operations, US Nuclear Regulatory Commission (NRC). Topics include the NRC analysis of the US Department of Energy Site Characterization Plan for the high-level radioactive waste repository, the standards promulgated by the US Environmental Protection Agency for the disposal of high-level waste, the NRC policy statement on Below Regulatory Concern, technical documents prepared by the NRC Staff relative to the decommissioning of nuclear power plants, the stabilization of uranium mill tailings piles, and environmental monitoring. All reports prepared by the Committee have been made available to the public through the NRC Public Document Room and the US Library of Congress. Included in an Appendix is a listing of references to related reports on nuclear waste matters that were issued by the Advisory Committee on Reactor Safeguards prior to the establishment of the ACNW.

52805 (ORNL/TM–11554) **Characteristics Data Base: Programmer's guide to the High-Level Waste Data Base.** Jones, K.E. (DataPhile, Inc., Knoxville, TN (USA)); Salmon, R. Oak Ridge National Lab., TN (USA); DataPhile, Inc., Knoxville, TN (USA); Automated Sciences Group, Inc., Oak Ridge, TN (USA). Aug 1990. 54p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC05-86OR21642. Order Number DE91001019. Source: NTIS, PC A04/MF A01; OSTI; INIS; GPO Dep.

The High-Level Waste Data Base is a menu-driven PC data base developed as part of OCRWM's technical data base on the characteristics of potential repository wastes, which also includes spent fuel and other materials. This programmer's guide completes the documentation for the High-Level Waste Data Base, the user's guide having been published previously. 3 figs.

52806 (ORNL/TM–11555) **Characteristics Data Base: Programmer's guide to the LWR Quantities Data Base.** Jones, K.E. (DataPhile, Inc., Knoxville, TN (USA)); Moore, R.S. Oak Ridge National Lab., TN (USA); DataPhile, Inc., Knoxville, TN (USA); Automated Sciences Group, Inc., Oak Ridge, TN (USA). Aug 1990. 90p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC05-84OR21400. Order Number DE91001022. Source: NTIS, PC A05/MF A01; OSTI; INIS; GPO Dep.

The LWR Quantities Data Base is a menu-driven PC data base developed as part of OCRWM's waste, technical data base on the characteristics of potential repository wastes, which also includes non-LWR spent fuel, high-level and other materials. This programmer's guide completes the documentation for the LWR Quantities Data Base, the user's guide having been published previously. The PC data base itself may be requested from the Oak Ridge National Laboratory, using the order form provided in Volume 1 of publication DOE/RW-0184.

52807 (ORNL/TM–11652) **Sampling and analysis of radioactive liquid wastes and sludges in the Melton Valley and evaporator facility storage tanks at ORNL.** Sears, M.B.; Botts, J.L.; Ceo, R.N.; Ferrada, J.J.; Griest, W.H.; Keller, J.M.; Schenley, R.L. Oak Ridge National Lab., TN (USA). Sep 1990. 212p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC05-84OR21400. Order Number DE91001021. Source: NTIS, PC A10/MF A01 - OSTI; GPO Dep.

The sampling and analysis of the radioactive liquid wastes and sludges in the Melton Valley Storage Tanks (MVSTs), as well as two of the evaporator service facility storage tanks at ORNL, are described. Aqueous samples of the supernatant liquid and composite samples of the sludges were analyzed for major constituents, radionuclides, total organic carbon, and metals listed as hazardous under the Resource Conservation and Recovery Act (RCRA). Liquid samples from five tanks and sludge samples from three tanks were analyzed for organic compounds on the Environmental Protection Agency (EPA) Target Compound List. Estimates were made of the inventory of liquid and sludge phases in the tanks. Descriptions of the sampling and analytical activities and tabulations of the results are included. The report provides data in support of the design of the proposed Waste Handling and Packaging Plant, the Liquid Low-Level Waste Solidification Project, and research and development activities (R&D) activities in developing waste management alternatives. 7 refs., 8 figs., 16 tabs.

52808 (PNL–7169) **Results from NNWSI [Nevada Nuclear Waste Storage Investigations] Series 2 bare fuel dissolution tests.** Wilson, C.N. Pacific Northwest Lab., Richland, WA (USA). Sep 1990. 105p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC06-76RL01830. Order Number DE91001051. Source: NTIS, PC A06/MF A01; OSTI; INIS; GPO Dep.

The dissolution and radionuclide release behavior of spent fuel in groundwater is being studied by the Nevada Nuclear Waste Storage Investigations (NNWSI) Project. Two bare spent fuel specimens plus the empty cladding hulls were tested in NNWSI J-13 well water in unsealed fused silica vessels under ambient hot cell air conditions (25°C) in the currently reported tests. One of the specimens was prepared from a rod irradiated in the H. B. Robinson Unit 2 reactor and the other from a rod irradiated in the Turkey Point Unit 3 reactor. Results indicate that most radionuclides of interest fall into three groups for release modeling. The first group principally includes the actinides (U, Np, Pu, Am, and Cm), all of which reached solubility-limited concentrations that were orders of magnitude below those necessary to meet the NRC 10 CFR 60.113 release limits for any realistic water flux predicted for the Yucca Mountain repository site. The second group is nuclides of soluble elements such as Cs, Tc, and I, for which release rates do not appear to be solubility-limited and may depend on the dissolution rate of fuel. In later test cycles, ^{137}Cs, ^{90}Sr, ^{99}Tc, and ^{129}I were continuously released at rates between about 5×10^{-5} and 1×10^{-4} of inventory per year. The third group is radionuclides that may be transported in the vapor phase, of which ^{14}C is of primary concern. Detailed test results are presented and discussed. 17 refs., 15 figs., 21 tabs.

52809 (PNL–7400) **Preconceptual design for a Monitored Retrievable Storage (MRS) transfer facility.** Woods, W.D. (Parsons (Ralph M.) Co., Pasadena, CA (USA)); Jowdy, A.K.; Smith, R.I. Pacific Northwest Lab., Richland, WA (USA); Parsons (Ralph M.) Co., Pasadena, CA (USA). Sep 1990. 127p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC06-84RL10436 ;AC06-76RL01830. Order Number DE91000502. Source: NTIS, PC A07/MF A01; OSTI; INIS; GPO Dep.

The contract between the DOE and the utilities specifies that the DOE will receive spent fuel from the nuclear utilities in 1998. This study investigates the feasibility of employing a simple Transfer Facility which can be constructed quickly, and operate while the full-scale MRS facilities are being constructed. The Transfer Facility is a hot cell designed only for the purpose of transferring spent fuel assemblies from the Office of Civilian Radioactive Waste Management (OCRWM) transport casks (shipped from the utility sites) into onsite concrete storage casks. No operational functions other than spent fuel assembly transfers and the associated cask handling, opening, and closing would be performed in this facility. Radioactive waste collected in the Transfer Facility during operations would be stored until the treatment facilities in the full-scale MRS facility became operational, approximately 2 years after the Transfer Facility started operation. An alternate wherein the Transfer Facility was the only waste handling building on the MRS site was also examined and evaluated. 6 figs., 26 tabs.

52810 (PNL–7468) **2101-M Pond hydrogeologic characterization report.** Chamness, M.A.; Luttrell, S.P.; Bates, D.J.; Martin, W.J. Pacific Northwest Lab., Richland, WA (USA). Sep 1990. 285p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC06-76RL01830. Order Number DE91000688. Source: NTIS, PC A13/MF A01 - OSTI; GPO Dep.

This report documents information collected by the Pacific Northwest Laboratory [(a)] at the request of Westinghouse Hanford Company. Presented in this report is the interpretation of the hydrogeologic environment at the 2101-M Pond, located in the 200-East Area of the Hanford Site. This information and its accompanying interpretation were derived from sampling and testing activities associated with the installation of four ground-water monitoring wells, in addition to data gathered from several previously existing wells. The new monitoring wells were installed as part of a groundwater monitoring program initiated in 1988. The four new

monitoring wells were installed around the 2101-M Pond between May 23 and August 27, 1988. Geologic sampling, aquifer testing, and initial ground-water sampling were performed during the installation of these wells. Laboratory analyses of the sediment samples for particle size, calcium carbonate content, and selected natural and contaminant constituents were performed. A full year of quarterly ground-water sampling and the first statistical analysis of background and downgradient data have also been performed. 112 refs., 49 figs., 18 tabs.

52811 (RFP–4396) **Fiscal year 1990 Rocky Flats Plant Environmental Restoration program Current-Year Work Plan.** Nielsen, T. (EG and G Rocky Flats, Inc., Golden, CO (USA)); Waage, E.; Miller, D. EG and G Rocky Flats, Inc., Golden, CO (USA). [1990]. 30p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC34-90DP62349. (CONF-900977–4-Draft: Spectrum '90: American Nuclear Society (ANS) international meeting on radioactive waste technologies, decontamination, and hazardous wastes, Knoxville, TN (USA), 30 Sep - 4 oct 1990). Order Number DE91001102. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The Rocky Flats Plant (RFP) is a nuclear weapons manufacturing facility currently operated by EG&G for the US Department of Energy (DOE). RFP is located at the foot of the Rocky Mountains in Jefferson Country, Colorado. The Fiscal Year 1990 (FY90) Current-Year Work Plan (CYWP) is intended to serve as a guidance document for the Environmental Restoration (ER) and RCRA Compliance programs that will be implemented at RFP. The CYWP provides in one document any cross-references necessary to understand the interrelationships between the CYWP and the DOE Five-Year Plan (FYP), Site-Specific Plan (SSP), and other related documents. The scope of this plan includes comparison of planned FY90 ER activities to those actually achieved. The CYWP has been updated to include Colorado Department of Health (CDH), US Environmental Protection Agency (EPA), and DOE Inter-Agency Agreement ER activities. It addresses hazardous wastes, radioactive wastes, mixed wastes (radioactive and hazardous), and sanitary wastes. The CYWP also addresses facilities and sites contaminated with or used in management of those wastes.

52812 (SAND–88-2845) **Data quality assurance controls through the WIPP [Waste Isolation Pilot Plant] In Situ Data Acquisition, Analysis, and Management System.** Munson, D.E. (Sandia National Labs., Albuquerque, NM (USA)); Ball, J.R.; Jones, R.L. Sandia National Labs., Albuquerque, NM (USA). Aug 1990. 14p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-900406–17: 1. international topical meeting on high-level radioactive waste management, Las Vegas, NV (USA), 8-12 Apr 1990). Order Number DE91000093. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Assurance of data quality for the in situ tests fielded at the Waste Isolation Pilot Plant is of critical importance. These tests supply the information for development and verification of the technology required for construction of a radioactive waste repository in bedded salt. The tests are some of the largest ever fielded in an underground facility. To assure that the extensive output generated by the tests is compatible with the high standards of quality required, a major project task was undertaken for the acquisition, control, and preservation of the all the associated in situ test databases, with the principal emphasis on the very large thermal/structural in situ tests. In order to accomplish this task the WIPP In Situ Data Acquisition, Analysis, and Management (WISDAAM) System was put into place. The system provides for quality control of the test databases and certified test data throughout the duration of the tests. 13 refs., 14 figs., 3 tabs.

52813 (SAND–89-2268) **Comparison of calculations and in situ results for a large, heated test room at the Waste Isolation Pilot Plant (WIPP).** Munson, D.E. (Sandia National Labs., Albuquerque, NM (USA)); DeVries, K.L.; Callahan, G.D. Sandia National Labs., Albuquerque, NM (USA). Aug 1990. 8p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-900646–1: 31. US symposium on rock mechanics, Golden, CO (USA), 18-20 Jun 1990). Order Number DE91000080. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The mission of the Waste Isolation Pilot Plant (WIPP) Project is to develop the technology for safe disposal of the radioactive Transuranic (TRU) waste forms generated by the US defense programs. The WIPP facility has been constructed in the bedded salt deposits of Southeastern New Mexico. In the existing regulatory context, the requirement is to assure that the potential repository isolates the radioactive waste from the accessible environment and mankind. This requirement means, in part, that the creep closure and waste encapsulation of the salt must be predicted far into the future, a capability which requires a significant development of predictive technology. A series of large scale in situ experiments were fielded at the WIPP specifically to provide a data base for validation of the independently developed prediction technology. In this paper, we present the results of one large scale, heated test as analyzed according to the most advanced predictive capability. The closure measurements from a large scale, heated, in situ experimental room in salt are compared to numerical calculations using the most recent predictive technology, with very good agreement, limited potentially only by the unmodeled roof fracture and separation. 9 refs., 6 figs., 1 tab.

52814 (UCRL-JC–104756) **Increasing the efficiency of the TOUGH code for running large-scale problems in nuclear waste isolation.** Nitao, J.J. Lawrence Livermore National Lab., CA (USA). Aug 1990. 6p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract W-7405-ENG-48. (CONF-9009228–2: Tough user's workshop, Berkeley, CA (USA), 13-14 Sep 1990). Order Number DE91000812. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

The TOUGH code developed at Lawrence Berkeley Laboratory (LBL) is being extensively used to numerically simulate the thermal and hydrologic environment around nuclear waste packages in the unsaturated zone for the Yucca Mountain Project. At the Lawrence Livermore National Laboratory (LLNL) we have rewritten approximately 80 percent of the TOUGH code to increase its speed and incorporate new options. The geometry of many requires large numbers of computational elements in order to realistically model detailed physical phenomena, and, as a result, large amounts of computer time are needed. In order to increase the speed of the code we have incorporated fast linear equation solvers, vectorization of substantial portions of code, improved automatic time stepping, and implementation of table look-up for the steam table properties. These enhancements have increased the speed of the code for typical problems by a factor of 20 on the Cray 2 computer. In addition to the increase in computational efficiency we have added several options: vapor pressure lowering; equivalent continuum treatment of fractures; energy and material volumetric, mass and flux accounting; and Stefan-Boltzmann radiative heat transfer. 5 refs.

52815 (WHC-EP–0188) **Corrosion behavior of copper-base materials in a gamma-irradiated environment: Final report.** Yunker, W.H. Westinghouse Hanford Co., Richland, WA (USA). Sep 1990. 115p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC06-87RL10930. Order Number DE91001286. Source: NTIS, PC A06/MF A01; OSTI; INIS; GPO Dep.

Specimens of three copper-base materials were corrosion tested with gamma radiation exposure dose rates in the range of 1.9×10^3 R/h to 4.9×10^5 R/h. Materials used were pure copper, 7% aluminum bronze and 30% copper-nickel. Exposures were performed in moist air at 95°C and 150°C and liquid Well J-13 water at 95°C, for periods of up to 16 months. Specimens were monitored for uniform weight loss, stress-induced corrosion and crevice corrosion. Specimen surfaces were examined visually at 10X magnification as well as by Auger Electron Spectroscopy, x-ray diffraction and metallography. Corrosion was not severe in any of the cases. In general, the pure copper was corroded most uniformly while the copper-nickel was the least reproducibly corroded. 11 refs, 40 figs., 15 tabs.

52816 (WHC-EP–0342) **Hanford Site stream-specific reports.** Westinghouse Hanford Co., Richland, WA (USA). Aug 1990. 42p. Sponsored by U.S. DOE Office of Environmental Restoration and Waste Management. DOE Contract AC06-87RL10930. Order Number DE91001175. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This document and the associated 33 stream-specific addenda were prepared in response to public comments received on the Hanford Federal Facility Agreement and Consent Order. The processes used to characterize the effluents and propose designations pursuant to the Washington (State) Administrative Code 173–303, Dangerous Waste Regulations, are described in this "parent" document. A combination of process knowledge and sampling data was used to accomplish these tasks. 26 refs., 1 fig., 4 tabs.

52817 (WHC-EP–0342-Add.2) **PUREX plant chemical sewer stream-specific report: PUREX/UOsub 3 operations: Addendum 2.** Westinghouse Hanford Co., Richland, WA (USA). Aug 1990. 121p. Sponsored by U.S. DOE Office of Environmental Restoration and Waste Management. DOE Contract AC06-87RL10930. Order Number DE91001162. Source: NTIS, PC A06/MF A01 - OSTI; GPO Dep.

The proposed wastestream designation for the PUREX Plan CSL wastestream is that this stream is not a dangerous waste, pursuant to the Washington (State) Administration Code (WAC) 173-303, Dangerous Waste Regulations. A combination of process knowledge and sampling data was used to make this determination. 22 refs., 10 figs., 30 tabs.

52818 (WHC-EP–0342-Add.3) **N Reactor effluent stream-specific report: Addendum 3.** Westinghouse Hanford Co., Richland, WA (USA). Aug 1990. 164p. Sponsored by U.S. DOE Office of Environmental Restoration and Waste Management. DOE Contract AC06-87RL10930. Order Number DE91001168. Source: NTIS, PC A08/MF A01 - OSTI; GPO Dep.

The N Reactor effluent is characterized in terms of its chemical and radiological composition, discharge history, and sources of discharge. The subject stream is a dilute aqueous effluent derived from circulating coolant systems and fuel storage basins within the reactor building. N Reactor is located on the Hanford Site in south-central Washington State. A process description of N Reactor and sampling data are presented as a basis for the effluent characterization. A designation pursuant to Washington State Dangerous Waste Regulations is also presented. This report supports an effort by the US Department of Energy to provide the public with information about liquid discharges to the soil at the Hanford Site and to assess the potential for migration of contaminants from the receiving sites of these liquid discharges. 26 refs., 11 figs., 13 tabs.

52819 (WHC-EP–0342-Add.4) **163N Demineralization Plant wastewater stream-specific report: Addendum 4.** Westinghouse Hanford Co., Richland, WA (USA). Aug 1990. 69p. Sponsored by U.S. DOE Office of Environmental Restoration and Waste Management. DOE Contract AC06-87RL10930. Order Number DE91001166. Source: NTIS, PC A04/MF A01; OSTI; INIS; GPO Dep.

The 163N Demineralization Plant wastewater is characterized in terms of its chemical and radiological composition, discharge history, and sources of discharge. The subject stream is a dilute aqueous effluent derived from the production of high-quality water for coolant systems at N Reactor and the Washington Public Power Supply System Hanford Generating Plant. N Reactor and the 163N facility are located on the Hanford Site in southcentral Washington State. A process description of the 163N facility and sampling data are presented as a basis for the wastewater characterization. A designation pursuant to Washington State Dangerous Waste Regulations is also presented. This report supports an effort by the US Department of Energy to provide the public with information about liquid discharges to the soil at the Hanford Site and to assess the potential for migration of contaminants from receiving sites of these liquid discharges. 19 refs., 7 figs., 11 tabs.

52820 (WHC-EP–0342-Add.5) **PUREX plant steam condensate stream-specific report: PUREX/UOsub 3 operations: Addendum 5.** Westinghouse Hanford Co., Richland, WA (USA). Aug 1990. 111p. Sponsored by U.S. DOE Office of Environmental Restoration and Waste Management. DOE Contract AC06-87RL10930. Order Number DE91001164. Source: NTIS, PC A06/MF A01 - OSTI; GPO Dep.

The proposed wastestream designation for the Plutonium-Uranium Extraction (PUREX) Plant Steam Condensate (SCD) wastestream is that this stream is not a dangerous waste, pursuant to the Washington (State) Administration Code (WAC) 173–303, Dangerous Waste Regulations. A combination of process knowledge and present sampling data was used to make this determination. 18 refs., 11 figs., 13 tabs.

52821 (WHC-EP–0342-Add.6) **B Plant Chemical Sewer stream-specific report: Addendum 6.** Peterson, K.A. Westinghouse Hanford Co., Richland, WA (USA). Aug 1990. 88p. Sponsored by U.S. DOE Office of Environmental Restoration and Waste Management. DOE Contract AC06-87RL10930. Order Number DE91001159. Source: NTIS, PC A05/MF A01; OSTI; INIS; GPO Dep.

The proposed wastestream designation for the B Plant Chemical Sewer (BCE) wastestream is that this stream is not a dangerous waste, pursuant to the Washington (State) Administration Code (WAC) 173-303, Dangerous Waste Regulations. A combination of process knowledge and sampling data was used to make this determination. 21 refs., 7 figs., 11 tabs.

52822 (WHC-EP–0342-Add.7) **UO_3/U-plant wastewater stream-specific report: Addendum 7.** Toebe, W.E.; Adams, L.L.L.; Hedengren, D.C. Westinghouse Hanford Co., Richland, WA (USA). Aug 1990. 86p. Sponsored by U.S. DOE Office of Environmental Restoration and Waste Management. DOE Contract AC06-87RL10930. Order Number DE91001160. Source: NTIS, PC A05/MF A01; OSTI; INIS; GPO Dep.

The proposed wastestream designation for the UO_3/U Plant Wastewater wastestream is that this stream is not a dangerous waste, pursuant to the Washington (State) Administration Code (WAC) 173-303, Dangerous Waste Regulations. A combination of process knowledge and sampling data was used to make this determination. 21 refs., 10 figs., 10 tabs.

52823 (WHC-EP–0342-Add.8) **Plutonium finishing plant wastewater stream-specific report.** Jensen, D.B. Westinghouse Hanford Co., Richland, WA (USA). Aug 1990. 142p. Sponsored by U.S. DOE Office of Environmental Restoration and Waste Management. DOE Contract AC06-87RL10930. Order Number DE91001161. Source: NTIS, PC A07/MF A01 - OSTI; GPO Dep.

The proposed wastestream designation for the Plutonium Finishing Plant Wastewater wastestream is that this stream is not a dangerous waste, pursuant to the Washington (State) Administration Code (WAC) 173-303, Dangerous Waste Regulations. A combination of process knowledge and sampling data was used to make this determination. 11 refs., 4 figs., 8 tabs.

52824 (WHC-EP–0342-Add.9) **S Plant Wastewater stream-specific report: Addendum 9.** Egge, R.G. Westinghouse Hanford Co., Richland, WA (USA). Aug 1990. 80p. Sponsored by U.S. DOE Office of Environmental Restoration and Waste Management. DOE Contract AC06-87RL10930. Order Number DE91001176. Source: NTIS, PC A05/MF A01 - OSTI; GPO Dep.

The proposed wastestream designation for the S Plant Wastewater wastestream is that this stream is not a dangerous waste, pursuant to the Washington (State) Administration Code (WAC) 173–303, Dangerous Waste Regulations. A combination of process knowledge and sampling data was used to make this determination. 21 refs., 12 figs., 8 tabs.

52825 (WHC-EP–0342-Add.10) **T Plant wastewater stream-specific report: Addendum 10.** Ayster, K.A. Westinghouse Hanford Co., Richland, WA (USA). Aug 1990. 78p. Sponsored by U.S. DOE Office of Environmental Restoration and Waste Management. DOE Contract AC06-87RL10930. Order Number DE91001174. Source: NTIS, PC A05/MF A01; OSTI; INIS; GPO Dep.

The proposed wastestream designation for T Plant wastewater wastestream is that this stream is not a dangerous waste, pursuant to the Washington (State) Administration Code (WAC) 173-303, Dangerous Waste Regulations. A combination of process knowledge and sampling data was used to make this determination. 21 refs., 9 figs., 10 tabs.

52826 (WHC-EP–0342-Add.11) **2724-W laundry wastewater stream-specific report: Addendum 11.** Westinghouse Hanford Co., Richland, WA (USA). Aug 1990. 95p. Sponsored by U.S. DOE Office of Environmental Restoration and Waste Management. DOE

Contract AC06-87RL10930. Order Number DE91001181. Source: NTIS, PC A05/MF A01; OSTI; INIS; GPO Dep.

The proposed wastestream designation for the 2742-W Laundry wastewater wastestream is that this stream is not a dangerous waste, pursuant to the Washington (State) Administration Code (WAC) 173-303, Dangerous Waste Regulations. A combination of process knowledge and sampling data was used to make this determination. 19 refs., 4 figs., 8 tabs.

52827 (WHC-EP–0342-Add.12) **PUREX Plant process condensate stream-specific report: Addendum 12.** Westinghouse Hanford Co., Richland, WA (USA). Aug 1990. 95p. Sponsored by U.S. DOE Office of Environmental Restoration and Waste Management. DOE Contract AC06-87RL10930. Order Number DE91001178. Source: NTIS, PC A05/MF A01 - OSTI; GPO Dep.

The proposed wastestream designation for the PUREX Plant PDD wastestream is that this stream is not a dangerous waste, pursuant to the Washington (State) Administration Code (WAC) 173-303, Dangerous Waste Regulations. A combination of process knowledge and sampling data was used to make this determination. 27 refs., 9 figs., 13 tabs.

52828 (WHC-EP–0342-Add.13) **222-S Laboratory wastewater stream-specific report: Addendum 13.** Hall, M.J. Westinghouse Hanford Co., Richland, WA (USA). Aug 1990. 179p. Sponsored by U.S. DOE Office of Environmental Restoration and Waste Management. DOE Contract AC06-87RL10930. Order Number DE91001185. Source: NTIS, PC A09/MF A01 - OSTI; GPO Dep.

The proposed wastestream designation for the 222-S Laboratory wastestream is that this stream is not a dangerous waste, pursuant to the Washington (State) Administration Code (WAC) 173-303, Dangerous Waste Regulations. A combination of process knowledge and sampling data was used to make this determination. 12 refs., 6 figs., 11 tabs.

52829 (WHC-EP–0342-Add.14) **PUREX [Plutonium-Uranium Extraction] Plant Ammonia Scrubber Condensate stream-specific report: Addendum 14.** Westinghouse Hanford Co., Richland, WA (USA). Aug 1990. 91p. Sponsored by U.S. DOE Office of Environmental Restoration and Waste Management. DOE Contract AC06-87RL10930. Order Number DE91001182. Source: NTIS, PC A05/MF A01; OSTI; INIS; GPO Dep.

The proposed wastestream designation for the 242-A Evaporator Process Condensate wastestream is that this stream is a dangerous waste, pursuant to the Washington (State) Administration Code (WAC) 173-303, Dangerous Waste Regulations. A combination of process knowledge and sampling data was used to make this determination. 16 refs., 7 figs., 11 tabs.

52830 (WHC-EP–0342-Add.15) **242-A evaporator process condensate stream-specific report: Addendum 15.** Westinghouse Hanford Co., Richland, WA (USA). Aug 1990. 146p. Sponsored by U.S. DOE Office of Environmental Restoration and Waste Management. DOE Contract AC06-87RL10930. Order Number DE91001183. Source: NTIS, PC A07/MF A01; OSTI; INIS; GPO Dep.

The proposed wastestream designation for the 242-A Evaporator Process Condensate wastestream is that this stream if a dangerous waste, pursuant to the Washington (State) Administration Code (WAC) 173–303, Dangerous Waste Regulations. A combination of process knowledge and sampling data was used to make this determination. 16 refs., 7 figs., 11 tabs.

52831 (WHC-EP–0342-Add.16) **B plant steam condensate stream-specific report.** Peterson, K.A. Westinghouse Hanford Co., Richland, WA (USA). Aug 1990. 60p. Sponsored by U.S. DOE Office of Environmental Restoration and Waste Management. DOE Contract AC06-87RL10930. Order Number DE91001184. Source: NTIS, PC A04/MF A01; OSTI; INIS; GPO Dep.

The proposed wastestream designation for the B Plant Steam Condensate (BSC) wastestream is that this stream is not a dangerous waste, pursuant to the Washington (State) Administration Code (WAC) 173-303, Dangerous Waste Regulations. A combination of process knowledge and sampling data was used to make this determination. 23 refs., 8 figs., 9 tabs.

52832 (WHC-EP–0342-Add.17) **B Plant Process Condensate stream-specific report: Addendum 17.** Peterson, K.A. Westinghouse Hanford Co., Richland, WA (USA). Aug 1990. 65p. Sponsored by U.S. DOE Office of Environmental Restoration and Waste Management. DOE Contract AC06-87RL10930. Order Number DE91001170. Source: NTIS, PC A04/MF A01 - OSTI; GPO Dep.

The B Plant Process Condensate wastestream cannot be designated at this time, pursuant to the Washington (State) Administration Code (WAC) 173–303, Dangerous Waste Regulations. Sampling data were not sufficient to make a designation. 23 refs., 7 figs., 10 tabs.

52833 (WHC-EP–0342-Add.19) **UO_3 plant process condensate stream-specific report: Addendum 19.** Toebe, W.E.; Hedengren, D.C.; Rasmussen, J.H.E. Westinghouse Hanford Co., Richland, WA (USA). Aug 1990. 107p. Sponsored by U.S. DOE Office of Environmental Restoration and Waste Management. DOE Contract AC06-87RL10930. Order Number DE91001165. Source: NTIS, PC A06/MF A01 - OSTI; GPO Dep.

The proposed wastestream designation for the UO_3 Plant Process Condensate wastestream is that this stream is not a dangerous waste, pursuant to the Washington (State) Administration Code (WAC) 173–303, Dangerous Waste Regulations. A combination of process knowledge and sampling data was used to make this determination. 19 refs., 11 figs., 12 tabs.

52834 (WHC-EP–0342-Add.20) **PUREX plant cooling water stream-specific report: PUREX/UOsub 3 operations: Addendum 20.** Westinghouse Hanford Co., Richland, WA (USA). Aug 1990. 101p. Sponsored by U.S. DOE Office of Environmental Restoration and Waste Management. DOE Contract AC06-87RL10930. Order Number DE91001163. Source: NTIS, PC A06/MF A01 - OSTI; GPO Dep.

The proposed wastestream designation for the Plutonium-Uranium Extraction (PUREX) Plant CWL wastestream is that this stream is not a dangerous waste, pursuant to the Washington (State) Administration Code (WAC) 173–303, Dangerous Waste Regulations. A combination of process knowledge and sampling data was used to make this determination. 18 refs., 10 figs., 13 tabs.

52835 (WHC-EP–0342-Add.23) **241-A Tank Farm Cooling Water stream-specific report: Addendum 23.** Westinghouse Hanford Co., Richland, WA (USA). Aug 1990. 65p. Sponsored by U.S. DOE Office of Environmental Restoration and Waste Management. DOE Contract AC06-87RL10930. Order Number DE91001172. Source: NTIS, PC A04/MF A01 - OSTI; GPO Dep.

The proposed wastestream designation for the 241-A Tank Farm Cooling Water wastestream is that this stream is not a dangerous waste, pursuant to the Washington (State) Administration Code (WAC) 173-303, Dangerous Waste Regulations. A combination of process knowledge and sampling data was used to make this determination. 19 refs., 4 figs., 7 tabs.

52836 (WHC-EP–0342-Add.25) **244-AR vault cooling water stream-specific report: Addendum 25.** Westinghouse Hanford Co., Richland, WA (USA). Aug 1990. 64p. Sponsored by U.S. DOE Office of Environmental Restoration and Waste Management. DOE Contract AC06-87RL10930. Order Number DE91001179. Source: NTIS, PC A04/MF A01; OSTI; INIS; GPO Dep.

The proposed wastestream designation for the 244-AR Vault cooling water wastestream is that this stream is not a dangerous waste, pursuant to the Washington (State) Administration Code (WAC) 173-303, Dangerous Waste Regulations. A combination of process knowledge and sampling data was used to make this determination. 21 refs., 6 figs., 7 tabs.

52837 (WHC-EP–0342-Add.26) **242-A evaporator steam condensate stream-specific report: Addendum 26.** Westinghouse Hanford Co., Richland, WA (USA). Aug 1990. 66p. Sponsored by U.S. DOE Office of Environmental Restoration and Waste Management. DOE Contract AC06-87RL10930. Order Number DE91001180. Source: NTIS, PC A04/MF A01; OSTI; INIS; GPO Dep.

The proposed wastestream designation for the 242-A Evaporator Steam Condensate wastestream is that this stream is not a dangerous waste, pursuant to the Washington (State) Administration Code (WAC) 173-303, Dangerous Waste Regulations. A combination of process knowledge and sampling data was used to make this determination. 20 refs., 7 figs., 6 tabs.

52838 (WHC-EP-0342-Add.28) **400 Area Secondary Cooling Water stream-specific report: Addendum 28.** Bloom, R.W. Westinghouse Hanford Co., Richland, WA (USA). Aug 1990. 166p. Sponsored by U.S. DOE Office of Environmental Restoration and Waste Management. DOE Contract AC06-87RL10930. Order Number DE91001173. Source: NTIS, PC A08/MF A01 - OSTI; GPO Dep.

The proposed wastestream designation for the 400 Area Secondary Cooling Water wastestream is that this stream is not a dangerous waste, pursuant to the Washington (State) Administration Code (WAC) 173-303, Dangerous Waste Regulations. A combination of process knowledge and sampling data was used to make this determination. 13 refs., 11 figs., 13 tabs.

52839 (WHC-EP-0342-Add.29) **242-S evaporator steam condensate stream-specific report: Addendum 29.** Westinghouse Hanford Co., Richland, WA (USA). Aug 1990. 67p. Sponsored by U.S. DOE Office of Environmental Restoration and Waste Management. DOE Contract AC06-87RL10930. Order Number DE91001167. Source: NTIS, PC A04/MF A01 - OSTI; GPO Dep.

The proposed wastestream designation for the 200 West Area 242-S Evaporator Steam Condensate wastestream is that this stream is not a dangerous waste, pursuant to the Washington (State) Administration Code (WAC) 173-303, Dangerous Waste Regulations. A combination of process knowledge and sampling data was used to make this determination. 19 refs., 7 figs., 7 tabs.

52840 (WHC-EP-0342-Add.30) **241-AY/AZ Tank Farms Steam Condensate stream-specific report: Addendum 30.** Westinghouse Hanford Co., Richland, WA (USA). Aug 1990. 51p. Sponsored by U.S. DOE Office of Environmental Restoration and Waste Management. DOE Contract AC06-87RL10930. Order Number DE91001186. Source: NTIS, PC A04/MF A01 - OSTI; GPO Dep.

The proposed wastestream designation for the 200 East Area 241-AY/AZ Tank Farms Steam Condensate wastestream is that this stream is not a dangerous waste, pursuant to the Washington (State) Administration Code (WAC) 173-303, Dangerous Waste Regulations. A combination of process knowledge and sampling data was used to make this determination. 18 refs., 6 figs., 6 tabs.

52841 (WHC-EP-0342-Add.31) **209-E laboratory reflector water stream-specific report: Addendum 31.** Neilsen, E.H. Westinghouse Hanford Co., Richland, WA (USA). Aug 1990. 49p. Sponsored by U.S. DOE Office of Environmental Restoration and Waste Management. DOE Contract AC06-87RL10930. Order Number DE91001187. Source: NTIS, PC A04/MF A01 - OSTI; GPO Dep.

The proposed wastestream designation for the 209-E Laboratory reflector water wastestream is that this stream is not a dangerous waste, pursuant to the Washington (State) Administration Code (WAC) 173-303, Dangerous Waste Regulations. A combination of process knowledge and sampling data was used to make this determination. 20 refs., 5 figs., 8 tabs.

52842 (WHC-EP-0342-Add.32) **T Plant Laboratory wastewater stream-specific report: Addendum 32.** Jeppson, D.W. Westinghouse Hanford Co., Richland, WA (USA). Aug 1990. 96p. Sponsored by U.S. DOE Office of Environmental Restoration and Waste Management. DOE Contract AC06-87RL10930. Order Number DE91001169. Source: NTIS, PC A05/MF A01 - OSTI; GPO Dep.

The proposed wastestream designation for the T Plant Laboratory wastestream is that this stream is not a dangerous waste, pursuant to the Washington (State) Administration Code (WAC) 173-303, Dangerous Waste Regulations. A combination of process knowledge and sampling data was used to make this determination. 19 refs., 7 figs., 15 tabs.

52843 (WHC-EP-0348) **Hanford Site waste management and environmental restoration integration plan.** Merrick, D.L. Westinghouse Hanford Co., Richland, WA (USA). 30 Apr 1990. 97p. Sponsored by U.S. DOE Office of Environmental Restoration and Waste Management. DOE Contract AC06-87RL10930. Order Number DE91001284. Source: NTIS, PC A05/MF A01; OSTI; INIS; GPO Dep.

The "Hanford Site Waste Management and Environmental Restoration Integration Plan" describes major actions leading to waste disposal and site remediation. The primary purpose of this document is to provide a management tool for use by executives who need to quickly comprehend the waste management and environmental restoration programs. The Waste Management and Environmental Restoration Programs have been divided into missions. Waste Management consists of five missions: double-shell tank (DST) wastes; single-shell tank (SST) wastes (surveillance and interim storage, stabilization, and isolation); encapsulated cesium and strontium; solid wastes; and liquid effluents. Environmental Restoration consists of two missions: past practice units (PPU) (including characterization and assessment of SST wastes) and surplus facilities. For convenience, both aspects of SST wastes are discussed in one place. A general category of supporting activities is also included. 20 refs., 14 figs., 7 tabs.

52844 (WHC-EP-0348-Suppl.1) **Hanford Site waste management and environmental restoration integration plan: Supplement 1, Level 2 activity networks.** Merrick, D.L. Westinghouse Hanford Co., Richland, WA (USA). Jun 1990. 42p. Sponsored by U.S. DOE Office of Environmental Restoration and Waste Management. DOE Contract AC06-87RL10930. Order Number DE91001301. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The Hanford Site Waste Management and Environmental Restoration Integration Plan, Supplement 1: Level 2 Activity Networks is being issued to provide detailed activity networks for three missions: the double-shell tank waste mission, the single-shell tank waste mission, and the solid waste mission. Supporting information can be found in the principal document, the Hanford Site Waste Management and Environmental Restoration Integration Plan, WHC-EP-0348. 2 refs., 3 figs.

52845 (WHC-EP-0350) **Hanford Waste Vitrification Plant applied technology plan.** Kruger, O.L. Westinghouse Hanford Co., Richland, WA (USA). Sep 1990. 173p. Sponsored by U.S. DOE Energy Research. DOE Contract AC06-87RL10930. Order Number DE91001171. Source: NTIS, PC A08/MF A01; OSTI; INIS; GPO Dep.

This Applied Technology Plan describes the process development, verification testing, equipment adaptation, and waste form qualification technical issues and plans for resolution to support the design, permitting, and operation of the Hanford Waste Vitrification Plant. The scope of this Plan includes work to be performed by the research and development contractor, Pacific Northwest Laboratory, other organizations within Westinghouse Hanford Company, universities and companies with glass technology expertise, and other US Department of Energy sites. All work described in this Plan is funded by the Hanford Waste Vitrification Plant Project and the relationship of this Plan to other waste management documents and issues is provided for background information. Work to performed under this Plan is divided into major areas that establish a reference process, develop an acceptable glass composition envelope, and demonstrate feed processing and glass production for the range of Hanford Waste Vitrification Plant feeds. Included in this work is the evaluation and verification testing of equipment and technology obtained from the Defense Waste Processing Facility, the West Valley Demonstration Project, foreign countries, and the Hanford Site. Development and verification of product and process models and other data needed for waste form qualification documentation are also included in this Plan. 21 refs., 4 figs., 33 tabs.

52846 (WHC-SP-0464-Rev.1) **Assessment of double-shell tank waste pretreatment options: Revision 1.** Westinghouse Hanford Co., Richland, WA (USA). Jan 1990. 172p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC06-87RL10930. Order Number DE91001285. Source: NTIS, PC A08/MF A01 - OSTI; GPO Dep.

Work by Westinghouse Hanford Company (WHC) in Assessing double-shell tank waste pretreatment options was presented to the US Department of Energy-Richland Operations Office (DOE-RL) in a two-day workshop in May 1989. The recommendation (Option B) was accepted by DOE-RL in June 1989 with the provision that this option be adjusted to allow on-time completion of Tri-Party Agreement (TPA) commitments and that technical, safety and regulatory issues be resolved. The purpose of this revision to the Assessment of Double-Shell Tank Waste Pretreatment Options is to document the resolution of technical regulatory and safety issues and DOE-RL's acceptance of the recommended option. Near term actions taken to support the various options pending DOE approval, are also described. Revisions to this study are limited to the addition of this preface and two appendices. Appendix A contains correspondence between DOE-RL and WHC which identifies the issues, defines a plan for resolving the issues, and provides final acceptance of the recommended option. Appendix B provides a summary of the work performed to resolve the issues.

52847 (WSRC-RP-89-1442) **Development and application of a mathematical model for the benzene stripping columns in the In-Tank Precipitation (ITP) process.** Georgeton, G.K. Westinghouse Savannah River Co., Aiken, SC (USA). 28 Dec 1989. 33p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC09-89SR18035. Order Number DE91000778. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A mathematical model characterizing the operation of the benzene stripping columns in the In-Tank Precipitation (ITP) process has been developed. The model was verified using operations data of two stripping columns, and the model predicted reasonable, conservative values of the height of a transfer unit (HTU) and outlet solute concentrations. The model was applied to predict general operating efficiency of the ITP strippers, and predictions indicate that the stripping columns will be able to satisfy benzene removal requirements. 12 refs.

52848 **Gas generation from the irradiation of mortar.** Lewis, M.A. (Argonne National Lab., IL (USA)); Warren, D.W. pp. 97-112 of Ceramic transactions: Nuclear waste management 3. Volume 9. Mellinger, G.B. American Ceramic Society Inc., Columbus, OH (USA) (1990). pp. 595 DOE Contract W-31-109-ENG-38. (CONF-9004236--: 4. international symposium on ceramics in nuclear waste management, Indianapolis, IN (USA), 24-26 Apr 1990).

A mortar formulation capable of immobilizing chloride salts with high levels of radioactivity is being developed. As part of the developmental effort, radiation effects are investigated. The radiolytic generation of gas(es) from irradiated mortar formulations was determined for several formulations with variable salt loadings at 25 and 120°C. The irradiation of a mortar formulation consisting of cement, slag, fly ash, water, and 0 to 10 wt % salt led to the generation of hydrogen. The rate of generation was approximately constant, steady state pressures were not attained, and final pressures were comparatively high. The hydrogen yield was higher for mortar with 10 wt % salt than with 0 or 3 wt % salt at ambient temperature, but it was lower at 120°C. The irradiation of a mortar consisting of cement, fly ash, water, and salt led to the radiolytic generation of both oxygen and hydrogen.

52849 **Current DOE direction in low-level waste management.** Wilhite, E.L. (Savannah River Lab., Aiken, SC (USA)); Dolenc, M.R.; Shupe, M.W.; Waldo, L.C. pp. 1-3 of Waste processing, transportation, storage and disposal, technical programs and public education: Volume 2. Low-level waste. Post, R.G. Arizona Board of Regents, Tucson, AZ (USA) (1989). pp. 844 DOE Contract AC07-76ID01570. (CONF-890207--: Waste management '89: 15th international waste management symposium conference, Tucson, AZ (USA), 26 Feb - 2 mar 1989).

The U.S. Department of Energy (DOE) is implementing revised DOE Order 5820.2A Radioactive Waste Management. Chapter III of the revised order provides prescriptive requirements for managing low-level waste and is the subject of this paper. The revised order requires that all DOE low-level radioactive and mixed waste be systematically managed, using an approach that considers the combination of waste management practices used in waste generation reduction, segregation, treatment, packaging, storage, and disposal. The Order defines performance objectives for protecting groundwater, for protecting against intrusion, and for maintaining adequate operational practices. A performance assessment will be required to ensure that waste management operations comply with these performance objectives. DOE implementation of the revised Order includes work in the areas of leach testing, waste stabilization, waste certification, facility monitoring, and management of unique waste streams. This paper summarizes the status of this work and the current direction DOE is taking in managing low-level waste under DOE 5820.2A.

52850 **Integrated waste management plan for the Savannah River Plant.** Cook, J.R. (Savannah River Lab., Aiken, SC (USA)); Sturm, H.F. Jr.; Hoisington, J.E. pp. 11-14 of Waste processing, transportation, storage and disposal, technical programs and public education: Volume 2. Low-level waste. Post, R.G. Arizona Board of Regents, Tucson, AZ (USA) (1989). pp. 844 DOE Contract AC09-76SR00001. (CONF-890207--: Waste management '89: 15th international waste management symposium conference, Tucson, AZ (USA), 26 Feb - 2 mar 1989).

The Savannah River Plant will begin operation of several new waste disposal and treatment facilities during the next five years which will affect all waste streams generated on site. These will include a new solid low-level radioactive waste disposal facility, a hazardous/mixed waste disposal facility, and a low-level liquid waste solidification process. Existing waste sites will be closed in a technically and environmentally sound manner. Facility designs and closure plans are based on site-specific performance assessments and data from comprehensive monitoring systems. In addition, significant technical effort is directed toward waste volume reduction. These programs include compaction, incarnation, waste voidance, and clean waste segregation. This paper describes how these are elements of an integrated waste management plan that was developed to insure not only an effective, coordinated transition to these new facilities but to significantly enhance the overall site environmental management program.

52851 **Existing LLW treatment and disposal technology offers 17-to-1 volume reduction and advanced disposal at low cost.** Darnell, G.R. (Idaho National Engineering Lab., Idaho Falls, ID (USA)); Larsen, M.M. pp. 15-21 of Waste processing, transportation, storage and disposal, technical programs and public education: Volume 2. Low-level waste. Post, R.G. Arizona Board of Regents, Tucson, AZ (USA) (1989). pp. 844 DOE Contract AC07-76ID01570. (CONF-890207--: Waste management '89: 15th international waste management symposium conference, Tucson, AZ (USA), 26 Feb - 2 mar 1989).

This paper reports how existing technology was used to develop a conceptual design for a waste treatment and disposal complex (WTDC). The designed facility would treat nearly 100% of all solid low-level radioactive waste (LLW), regardless of waste classification. Approximately 95 vol% of all LLW would be delivered in reusable shipment containers to the WTDC, where treatment would produce a liquid-free, install-compacted, 98 vol% inorganic waste. The treated waste would be packed with contaminated grout in uniform, smooth-sided, thin-walled, steel boxes. The boxes are stacked tightly in abovegrade, earth-mounded, concrete, disposal vaults, where they will be protected from water after vault closure. The 210-pound-per-cubic-foot waste prevents subsidence. Engineered earthen covers are covered over the vaults at the final closure and should keep water out of the waste long after vault degradation. A volume reduction factor of 17-to-1 is achieved through sorting, incineration, metal sizing operations, intense compaction, and grouting.

52852 **Experience with the tumulus technology for the disposal of solid low-level radioactive waste.** Garland, S.B. (Oak Ridge National Lab., TN (USA). Environmental Sciences Div.); Van Hoesen, S.D.; Scanlan, T.F. pp. 23-28 of Waste processing, transportation, storage and disposal, technical programs and public education: Volume 2. Low-level waste. Post, R.G. Arizona Board of Regents, Tucson, AZ (USA) (1989). pp. 844 DOE Contract AC05-84OR21400. (CONF-890207--: Waste management '89: 15th international waste management symposium conference, Tucson, AZ (USA), 26 Feb - 2 mar 1989).

As part of the development of a long-range plan for the disposal of solid low-level radioactive waste, a full-scale tumulus facility has

been built as a technology demonstration. This aboveground facility consists of a concrete pad on which the waste is placed, a synthetic underpad liner, concrete disposal vaults to contain the waste, a performance monitoring system, and a multilayered cap to be constructed after the pad is filled. Waste has already been placed on the pad, and the suitability of the design, the construction, and the operating procedures has been assessed. This paper reports that the facility appears to be acceptable with the exception of the underpad liner, which will be eliminated in subsequent tumulus facilities. Radiation monitoring of the workers and environmental monitoring have shown essentially no impacts above background.

52853 DOE disposal cell design and surveillance and maintenance programs. Caldwell, J.A. (Jacobs Engineering Group, Inc. (US)); Kyllo, M.; Matthews, M.; D'Antonio, J. pp. 29-35 of Waste processing, transportation, storage and disposal, technical programs and public education: Volume 2. Low-level waste. Post, R.G. Arizona Board of Regents, Tucson, AZ (USA) (1989). pp. 844 (CONF-890207–: Waste management '89: 15th international waste management symposium conference, Tucson, AZ (USA), 26 Feb - 2 mar 1989).

The U.S. Department of Energy's Office of Remedial Action and Waste Technology is responsible for a number of remedial action programs that involve constructing disposal cells to contain wastes resulting from the milling of uranium and other similar activities. Once the cells have been constructed, the DOE is responsible for continuing surveillance and maintenance activities at the sits. In order to ensure dissemination of ideas and technical approaches across the various programs for which the office is responsible, a number of working groups convened, special studies were undertaken, and new approaches to disposal cell design and surveillance and maintenance were identified. This paper reports that a checklist approach to the design of disposal cells was established; this involves a compendium of possible cell perimeter dike details and top cover components from which the designer selects elements appropriate to the conditions of the specific site.

52854 Product performance of the pilot-scale in-situ vitrification of a simulated waste disposal site at the Oak Ridge National Laboratory. Bates, S.O. (Pacific Northwest Lab., Richland, WA (USA)); Carter, J.G.; Koegler, S.S. pp. 123-136 of Ceramic transactions: Nuclear waste management 3. Volume 9. Mellinger, G.B. American Ceramic Society Inc., Columbus, OH (USA) (1990). pp. 595 DOE Contract AC06-76RL01830. (CONF-9004236–: 4. international symposium on ceramics in nuclear waste management, Indianapolis, IN (USA), 24-26 Apr 1990).

Process feasibility and waste form performance studies have been successfully performed for applying in-situ vitrification (ISV) to intermediate-level (low level) waste placed in seepage pits and trenches at Oak Ridge National Laboratory (ORNL). A pilot-scale ISV test 3/8-scale simulation of an ORNL trench was constructed and vitrified at ORNL. The pilot-scale waste form consisted of a glass phase and a multi-crystalline devitrification product. Both these phases had essentially the same elemental composition. The durability of the waste form was evaluated by MCC-1, MCC-3, and EP toxicity tests. This paper reports that the durability of the waste form was found to be similar to or better than two high-level nuclear waste glasses (i.e., PNL-76-78 and SRL-165).

52855 Expediting cleanup at the Weldon Spring Site under CERCLA and NEPA. Peterson, J.M. (Argonne National Lab., IL (USA). Energy and Environmental Systems Div.); MacDonell, M.M.; Haroun, L.A.; McCracken, S.H. pp. 125-129 of Waste processing, transportation, storage and disposal, technical programs and public education: Volume 2. Low-level waste. Post, R.G. Arizona Board of Regents, Tucson, AZ (USA) (1989). pp. 844 (CONF-890207–: Waste management '89: 15th international waste management symposium conference, Tucson, AZ (USA), 26 Feb - 2 mar 1989).

This paper reports on the Weldon Spring Site Remedial Action Project which is being conducted under the Surplus Facilities Management Program of the U.S. Department of Energy (DOE). The DOE has developed an environmental compliance strategy for this project to meet the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the National Environmental Policy Act (NEPA). A key element of this strategy was the development of an integrated CERCLA/NEPA process to minimize, to the extent possible, the need to prepare duplicate documentation. Additionally, the project is implementing various expedited response actions to mitigate actual or potential uncontrolled releases of radioactively or chemically hazardous substances to the environment and to minimize potential health and safety risks to on-site personnel and local human and biotic populations. These actions are being conducted concurrently with the implementation of site characterization activities and the preparation of major environmental compliance documentation.

52856 A program optimization system for the cleanup of DOE hazardous waste sites an application to FY 1990 funding decisions. Merkhofer, M.W. (Applied Decision Analysis, Inc., Menlo Park, CA (USA)); Jenni, K.E.; Cotton, T.A.; Lehr, J.C.; Longo, T.P. pp. 149-158 of Waste processing, transportation, storage and disposal, technical programs and public education: Volume 2. Low-level waste. Post, R.G. Arizona Board of Regents, Tucson, AZ (USA) (1989). pp. 844 (CONF-890207–: Waste management '89: 15th international waste management symposium conference, Tucson, AZ (USA), 26 Feb - 2 mar 1989).

This paper describes a formal system used by the Department of Energy (DOE) as an aid for allocating funds for cleaning up hazardous waste sites. The system, called the Program Optimization System (POS), is based on multiattribute utility analysis and was developed for DOE's Hazardous Waste and Remedial Actions Division (HWRAD). HWRAD has responsibility for recommending environmental restoration (ER) activities to the Assistant Secretary of Energy. Recently, the POS was used to analyze and recommend funding levels for FY 1990 cleanup activities at DOE defense program facilities.

52857 Progress and issues in FUSRAP and SFMP. Fiore, J.J. (Div. of Facility and Site Decommissioning Projects, US DOE, Washington, DC (US)); Gross, P.J. pp. 119-123 of Waste processing, transportation, storage and disposal, technical programs and public education: Volume 2. Low-level waste. Post, R.G. Arizona Board of Regents, Tucson, AZ (USA) (1989). pp. 844 (CONF-890207–: Waste management '89: 15th international waste management symposium conference, Tucson, AZ (USA), 26 Feb - 2 mar 1989).

This paper reports how the Formerly Utilized Sites Remedial Action Program (FUSRAP) and the Surplus Facilities Management Program (SFMP) have made steady progress in cleaning up facilities and sites across the United States. Over the past year, the FUSRAP completed remediation of sites in Illinois, New Jersey, and New York. At many other sites, work continued on characterizing the contamination to enable remedial action plans, environmental compliance documentation, and designs to be developed. For SFMP, the Shippingport project continued to be a model of cost and schedule management with preparation of the reactor pressure vessel for transport to the Hanford Reservation for disposal. On the Weldon Spring Project in Missouri, interim remedial actions were started to address immediate environmental concerns while site characterization continued. DOE also made steady progress on smaller projects such as the Mound project in Ohio and the Experimental Boiling Water Reactor in Illinois.

52858 Planning for the offsite disposal of waste generated in the remediation of the Denver Radium Superfund Site. Archibald, J.K. (UNC Geotech, Grand Junction, CO (USA)); Jacobson, C.L.; Virgona, J.; Brink, J.A. pp. 137-141 of Waste processing, transportation, storage and disposal, technical programs and public education: Volume 2. Low-level waste. Post, R.G. Arizona Board of Regents, Tucson, AZ (USA) (1989). pp. 844 (CONF-890207–: Waste management '89: 15th international waste management symposium conference, Tucson, AZ (USA), 26 Feb - 2 mar 1989).

In this paper, plans for the offsite disposal of waste from the Denver Radium Superfund Site are discussed. The Denver Radium Site consists of over forty radium contaminated properties in Metropolitan Denver. These properties were contaminated from the production of radium during the early twentieth century. The properties have housed a variety of activities, and uses now vary from empty land to warehouses to retail and manufacturing facilities. The remedial action project currently under way at the Denver Radium Site is one of the largest in the United States where the selected remedy is offsite disposal.

52859 WIPP/SRL in-situ tests: MIIT program-surface studies of SRL waste glasses. Tacca, J.A. (Clemson Univ., SC (USA). Dept. of Ceramic Engineering); Wicks, G.G. pp. 271-286 of Ceramic transactions: Nuclear waste management 3. Volume 9. Mellinger, G.B. American Ceramic Society Inc., Columbus, OH (USA) (1990). pp. 595 (CONF-9004236–: 4. international symposium on ceramics in nuclear waste management, Indianapolis, IN (USA), 24-26 Apr 1990).

The first in-situ tests involving burial of simulated, non-radioactive waste glasses and package components in the United States was begun in 1986. The effort involves almost 2000 specimens from seven nations buried in the salt site at the Waste Isolation Pilot Plant (WIPP) in Carlsbad, New Mexico. Among these samples are non-radioactive Savannah River Laboratory (SRL) waste glasses which have been buried for 6-mo., 1-yr. and 2-yrs., as part of a 5-yr. study. Scanning electron microscopy (SEM), energy dispersion x-rays (EDX), and wide angle x-ray diffraction (WAXD) were used to assess the behavior of these glasses and are presented.

52860 Development of a mixed waste management facility at the Nevada test site. Dodge, R.L. (Reynolds Electrical and Engineering Co., Inc., Las Vegas, NV (USA)); Kendall, E.W.; Fitzsimmons, P.K.; O'Neill, L.J. pp. 211-213 of Waste processing, transportation, storage and disposal, technical programs and public education: Volume 2. Low-level waste. Post, R.G. Arizona Board of Regents, Tucson, AZ (USA) (1989). pp. 844 (CONF-890207–: Waste management '89: 15th international waste management symposium conference, Tucson, AZ (USA), 26 Feb - 2 mar 1989).

The U.S. Department of Energy (DOE) produces radioactive low-level wastes (LLW) which contain hazardous components as identified by 40 Code of Federal Regulations (CFR) 261. Management of those mixed wastes (MW) requires compliance with U.S. Environmental Protection Agency (EPA) and state of Nevada regulations for hazardous wastes and DOE regulations for LLW. In 1988, DOE's Nevada Operations Office (NV) began receiving specific MW at the Nevada Test Site (NTS) under interim status as authorized by the state of Nevada. MW operations are currently limited to receipt of pondcrete and salcrete from Rocky Flats Plant and disposal in an existing pit while operating under interim status. Preparations for operation of a separate mixed waste management unit (MWMU) are underway. Planned activities relating to the development of the MWMU are discussed.

52861 System design, construction, and start-up of the Hanford transportable grout equipment facility. Gaines, H. Jr. (ATI/UD Ecology Nuclear, Charlotte, NC (US)); Carrigan, M.C. pp. 225-227 of Waste processing, transportation, storage and disposal, technical programs and public education: Volume 2. Low-level waste. Post, R.G. Arizona Board of Regents, Tucson, AZ (USA) (1989). pp. 844 (CONF-890207–: Waste management '89: 15th international waste management symposium conference, Tucson, AZ (USA), 26 Feb - 2 mar 1989).

This paper reports on the development of a grouting process for the immobilization and final disposal of various mixed low level radioactive phosphate/sulfate wastes from the Handord N-reactor operations. The processing facility was designed using a modular concept featuring totally remote maintenance capability where necessary. The unit is capable of processing waste with activity levels up to 1.75 Ci/liter. The modules were fabricated and assembled off-site and transported to the Hanford site where they were installed in the prepared site. The units were then electrically and mechanically interconnected prior to testing.

52862 Results of field testing of waste forms using lysimeters. McConnell, J.W. Jr. (EG and G Idaho, Inc., Idaho Falls, ID (USA). Idaho National Engineering Lab.); Rogers, R.D. pp. 291-299 of Waste processing, transportation, storage and disposal, technical programs and public education: Volume 2. Low-level waste. Post, R.G. Arizona Board of Regents, Tucson, AZ (USA) (1989). pp. 844 DOE Contract AC07-76ID01570. (CONF-890207–: Waste management '89: 15th international waste management symposium conference, Tucson, AZ (USA), 26 Feb - 2 mar 1989).

The TMI-2 EPICOR-II Resin/Liner Low-Level Waste Data Base Development Program is obtaining information on the performance of radioactive waste in a disposal environment. Waste forms fabricated using ion exchange resins from EPICOR-II prefilters employed in the cleanup of the Three Mile island Nuclear Power Station are being tested to: develop a low-level waste data base and obtain information on survivability of waste forms in a disposal environment. This paper updates field testing of those waste forms during FY-1988, presents results of waste form leach-testing, and compares those results to the releases of radionuclides from these lysimeter waste forms.

52863 Department of Energy-Savannah River program for compliance with the Resource Conservation and Recovery Act. Browning, D.S. (Chem-Nuclear Systems, Inc., Columbia, SC (US)). pp. 243-247 of Waste processing, transportation, storage and disposal, technical programs and public education: Volume 2. Low-level waste. Post, R.G. Arizona Board of Regents, Tucson, AZ (USA) (1989). pp. 844 (CONF-890207–: Waste management '89: 15th international waste management symposium conference, Tucson, AZ (USA), 26 Feb - 2 mar 1989).

The Savannah River Plant (SRP) is a Department of Energy (DOE) installation that produces nuclear materials for defense and research purposes and currently generates hazardous and mixed waste. Past management practices for such waste have included disposal in seepage basins and storage in interim storage facilities. As with other industrial and federal facilities, DOE-Savannah River (DOE-SR) waste management operations have changed over the years due to increased environmental awareness and changing environmental regulations, in particular, the complex requirements of the Resource Conservation and Recovery Act (RCRA). This paper discusses actions taken and planned, by DOE-SR, at the SRP to achieve compliance with the requirements of the RCRA and subsequent amendments.

52864 Department of Energy defense activities for hazardous and mixed waste reduction. Rothermich, N.E. (Hazardous Waste Remedial Actions Program Support Contractor Office, Oak Ridge, TN (US)); Anderson, T.D.; Mathur, S.P. pp. 267-270 of Waste processing, transportation, storage and disposal, technical programs and public education: Volume 2. Low-level waste. Post, R.G. Arizona Board of Regents, Tucson, AZ (USA) (1989). pp. 844 (CONF-890207–: Waste management '89: 15th international waste management symposium conference, Tucson, AZ (USA), 26 Feb - 2 mar 1989).

This paper provides the Department of Energy (DOE) working definition of waste minimization, including the specific policy set forth for defense programs. It summarizes the generic waste minimization approaches of the DOE sites and describes some site activities to minimize the volume and toxicity of waste generated by Defense Programs (DP) operations.

52865 Achieving RCRA compliance in DOE defense waste management operations. Frankhauser, W.A. (Office of Defense Waste and Transportation Management, U.S. Dept. of Energy, Germantown, MD (US)); Shepard, M.D. pp. 237-241 of Waste processing, transportation, storage and disposal, technical programs and public education: Volume 2. Low-level waste. Post, R.G. Arizona Board of Regents, Tucson, AZ (USA) (1989). pp. 844 (CONF-890207–: Waste management '89: 15th international waste management symposium conference, Tucson, AZ (USA), 26 Feb - 2 mar 1989).

The U.S. Department of Energy (DOE) generates significant volumes of radioactive mixed waste (RMW) through its defense-related activities. Defense RMW is co-regulated by DOE and the U.S. Environmental Protection Agency/State agencies in accordance with requirements of the Resource Conservation and Recovery Act (RCRA) and the Atomic Energy Act (AEA). This paper highlights some of the problems encountered in co-regulation and discusses achievements of the defense waste management program in integrating RCRA requirements into RMW operations. Defense waste sites are planning facility modifications and major new construction projects to develop treatment, storage and disposal capacity for existing RMW inventories and projected needs.

52866 Resource Conservation and Recovery Act compliance at the Hanford Site. Badden, J.W. (Westinghouse Hanford Co., Richland, WA (USA)); Wiegman, S.A.; Bracken, E.A. pp. 253-255 of Waste processing, transportation, storage and disposal,

technical programs and public education: Volume 2. Low-level waste. Post, R.G. Arizona Board of Regents, Tucson, AZ (USA) (1989). pp. 844 (CONF-890207–: Waste management '89: 15th international waste management symposium conference, Tucson, AZ (USA), 26 Feb - 2 mar 1989).

Successful implementation of the Resource Conservation and Recovery Act (RCRA) at the Hanford Site has been and will continue to be a significant challenge. The 560 square mile site encompasses over a thousand facilities and waste sites that are influenced by the complex and changing regulatory framework of RCRA. The challenge is enhanced by the relatively new application of RCRA to mixed waste, which contains both radionuclides and hazardous constituents. This paper provides an overview of the approaches being used to achieve and maintain compliance.

52867 Long range planning, scheduling and budgeting for the environmental compliance program at the Rocky Flats Plant. McKinley, K.B. (Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant); Nielsen, T.H.; Raudenbush, M.H.; Flook, J.E.; O'Neil, P.J. pp. 263-265 of Waste processing, transportation, storage and disposal, technical programs and public education: Volume 2. Low-level waste. Post, R.G. Arizona Board of Regents, Tucson, AZ (USA) (1989). pp. 844 (CONF-890207–: Waste management '89: 15th international waste management symposium conference, Tucson, AZ (USA), 26 Feb - 2 mar 1989).

This paper reports how the Rocky Flats RCRA/CERCLA group at the Rocky Flats Plant in Golden, Colorado is developing a computerized schedule and budget management system. The system will aggregate schedule, budgets, and regulatory commitments provided by RCRA/CERCLA program managers. The system will provide tabular and graphical representations of the schedule and budget information at various levels of detail. The system will perform a variety of analyses on the schedule and budget. The RCRA/CERCLA group will use the results to develop realistic compliance schedules and the budgets necessary to meet them. Presentation of the schedules and budgets in a consistent graphical and tabular form will give a good appreciation of the remediation costs as understood by the RCRA/CERCLA group. The system will then be used to test resource availability and remediation period scenarios, differing from the optimal combination as determined by the RCRA/CERCLA group.

52868 WIPP/SRL in-situ tests: Laboratory support experiments. Ramsey, W.G. (Clemson Univ., SC (USA). Dept. of Ceramic Engineering); Wicks, G.G. pp. 335-346 of Ceramic transactions: Nuclear waste management 3. Volume 9. Mellinger, G.B. American Ceramic Society Inc., Columbus, OH (USA) (1990). pp. 595 (CONF-9004236–: 4. international symposium on ceramics in nuclear waste management, Indianapolis, IN (USA), 24-26 Apr 1990).

Simulated Savannah River waste glass was leached in brine and deionized water, with and without metals present, at 90°C, in support of the WIPP/SRL in-situ testing program. This paper discusses how the behavior of Savannah River Laboratory (SRL) 165/TDS waste glass was assessed by combining solution analysis with bulk and surface studies, and correlating laboratory results with field data. The glass, whose performance was affected by salt phases formed, performed well. The metals 304L stainless steel, Ticode 12, and lead had no significant effect on glass leaching, while A216 adversely affected the leaching of the waste glass system.

52869 Development of an accelerated leach test. Fuhrmann, M. (Nuclear Waste Research Group, Brookhaven National Lab., Upton, NY (US)); Pietrzak, R.F.; Heiser, J.; Franz, E.M.; Colombo, P. pp. 305-309 of Waste processing, transportation, storage and disposal, technical programs and public education: Volume 2. Low-level waste. Post, R.G. Arizona Board of Regents, Tucson, AZ (USA) (1989). pp. 844 DOE Contract AC02-76CH00016. (CONF-890207–: Waste management '89: 15th international waste management symposium conference, Tucson, AZ (USA), 26 Feb - 2 mar 1989).

This paper reports on an accelerated leach test being developed for low-level radioactive waste forms that will provide data that can be extrapolated to estimate long-term releases. This paper describes the methods that are being used to provide a sound physical basis for this test. The approach has been to determine the experimental conditions that will give the maximum leach rate without disturbing the mechanisms of leaching. This requires that the leaching mechanism can be identified and that a mechanistically defensible model is available. Results of accelerated tests are compared to results from long-term standard tests to obtain the acceleration factor. Data curves are also compared to model results to ascertain that no change in mechanisms has occurred. For many applications, a diffusion model for a finite cylinder was used successfully.

52870 Studies on spent fuel dissolution behavior under Yucca Mountain repository conditions. Wilson, C.N. (Pacific Northwest Lab., Richland, WA (USA)); Bruton, C.J. pp. 423-442 of Ceramic transactions: Nuclear waste management 3. Volume 9. Mellinger, G. B. American Ceramic Society Inc., Columbus, OH (USA) (1990). pp. 595 (CONF-9004236–: 4. international symposium on ceramics in nuclear waste management, Indianapolis, IN (USA), 24-26 Apr 1990).

Nuclide concentrations measured in laboratory tests with PWR spent fuel specimens in Nevada Test Site J-13 well water are compared to equilibrium concentrations calculated using the EQ3/6 geochemical modeling code. Actinide concentrations in the laboratory tests reach steady-state values lower than those required to meet Nuclear Regulatory Commission (NRC) release limits. Differences between measured and calculated actinide concentrations are discussed in terms of the effects of temperature (25°C to 90°C), sample filtration, oxygen fugacity, secondary phase precipitation, and the thermodynamic data in use. The concentrations of fission product radionuclides in the laboratory tests tend to increase continuously with time, in contrast to the behavior of the actinides.

52871 Sampling and analysis strategies to support waste form qualification. Westsik, J.H. Jr. (Pacific Northwest Lab., Richland, WA (USA)); Pulsipher, B.A.; Eggett, D.L.; Kuhn, W.L. pp. 495-506 of Ceramic transactions: Nuclear waste management 3. Volume 9. Mellinger, G. B. American Ceramic Society Inc., Columbus, OH (USA) (1990). pp. 595 DOE Contract AC06-76RL01830. (CONF-9004236–: 4. international symposium on ceramics in nuclear waste management, Indianapolis, IN (USA), 24-26 Apr 1990).

As part of the waste acceptance process, waste form producers will be required to demonstrate that their glass waste form will meet minimum specifications, show that the process can be controlled to consistently produce an acceptable waste form, and provide documentation that the waste form produced meets specifications. Key to the success of these endeavors is adequate sampling and chemical and radiochemical analyses of the waste streams from the waste tanks through the process to the final glass product. This paper suggests sampling and analysis strategies for meeting specific statistical objectives of detection of compositions outside specification limits, prediction of final glass product composition, and estimation of composition in process vessels for both reporting and guiding succeeding process steps.

52872 Use of requirements-type logic trees to guide complex environmental remediation activities. Smith, T.H. (Idaho National Engineering Lab., Idaho Falls, ID (USA)). pp. 491-498 of Waste processing, transportation, storage and disposal, technical programs and public education: Volume 2. Low-level waste. Post, R.G. Arizona Board of Regents, Tucson, AZ (USA) (1989). pp. 844 (CONF-890207–: Waste management '89: 15th international waste management symposium conference, Tucson, AZ (USA), 26 Feb - 2 mar 1989).

This paper reports on a requirements-tree technique developed to help guide remedial actions through the complex network of regulatory and technical requirements. Application of this rigorous logic-diagram technique to one complex remedial action, involving radioactive mixed waste at the Idaho National Engineering Laboratory, provided useful results. Additional applications of the technique, in a wide variety of situations, will help to determine the range of its usefulness.

52873 Correlation of laboratory testing and actual operations for the West Valley supernatant treatment system. Kurath, D.E. (Pacific Northwest Lab., Richland, WA (USA)); Bray, L.A.; Ross, W.A.; Ploetz, D.K. pp. 529-538 of Ceramic transactions: Nuclear waste management 3. Volume 9. Mellinger, G.B. American

Ceramic Society Inc., Columbus, OH (USA) (1990). pp. 595 (CONF-9004236–: 4. international symposium on ceramics in nuclear waste management, Indianapolis, IN (USA), 24-26 Apr 1990).

An ion exchange process which removes Cs-137 from the supernatant liquid associated with neutralized Purex high-level waste at the West Valley Demonstration Project was developed. West Valley has now achieved initial operation of the supernatant treatment system, and results have confirmed that laboratory studies. This paper addresses the development of the predictions of system operations and the initial results of the system.

52874 Waste management strategy at the West Valley demonstration project. Maestas, E. (West Valley Project Office, U.S. Department of Energy, West Valley, NY (US)); Walter, H.F. pp. 521-528 of Ceramic transactions: Nuclear waste management 3. Volume 9. Mellinger, G.B. American Ceramic Society Inc., Columbus, OH (USA) (1990). pp. 595 (CONF-9004236–: 4. international symposium on ceramics in nuclear waste management, Indianapolis, IN (USA), 24-26 Apr 1990).

High-level radioactive waste stored at West Valley (New York) is to be immobilized in a durable boroscilicate glass for later emplacement in a federal repository. Technical choices concerning waste forms and solidification processes for both high-level and low-level waste and the selected options are discussed.

52875 Proposed noble metals-compatible melter: Preliminary modeling results. Peters, R.D. (Pacific Northwest Lab., Richland, WA (USA)); Elliott, M.L.; Chapman, C.C. pp. 567-580 of Ceramic transactions: Nuclear waste management 3. Volume 9. Mellinger, G.B. American Ceramic Society Inc., Columbus, OH (USA) (1990). pp. 595 DOE Contract AC06-76RL01830. (CONF-9004236–: 4. international symposium on ceramics in nuclear waste management, Indianapolis, IN (USA), 24-26 Apr 1990).

The noble metals palladium, rhodium, and ruthenium are present in waste to be vitrified at Hanford, and they can disrupt operations by precipitating and settling in the glass melter. This paper reports ongoing work to evaluate and better understand the characteristics of noble metals in support of the Hanford Waste Vitrification Plant. In this context, a sloped melter bottom, a bottom drain freeze valve, and three electrodes to enhance convection are being evaluated. This paper discusses the strategy for accommodating noble metals, describes theoretical modeling of freeze valve operation, and describes progress on physical modeling of the motion of glass and precipitates in the melter cavity. The investigation focuses on a sloped-bottom, three-electrode melter design, which is a promising approach for accommodating noble metals.

52876 Establishing a regulatory framework for a RCRA corrective action program. Krueger, J.W. (Los Alamos National Lab., Environmental Restoration Program, Technical Support Office, Los Alamos, NM (US)). pp. 557-566 of Waste processing, transportation, storage and disposal, technical programs and public education: Volume 2. Low-level waste. Post, R.G. Arizona Board of Regents, Tucson, AZ (USA) (1989). pp. 844 (CONF-890207–: Waste management '89: 15th international waste management symposium conference, Tucson, AZ (USA), 26 Feb - 2 mar 1989).

Recently, the environmental community has become keenly aware of problems associated with integration of the demanding regulations that apply to environmental restoration activities. Once can not attend an EPA-sponsored conference on Superfund without hearing questions concerning the Resource, Conservation, and Recovery Act (RCRA) and the applicability of the National Contingency Plan (NCP) to sites that do not qualify for the National Priorities List (NPL). In particular, the U.S. Department of Energy (DOE) has been greatly criticized for its inability to define a comprehensive approach for cleaning up its hazardous waste sites. This article presents two decision flowcharts designed to resolve some of this confusion for DOE. The RCRA/CERCLA integration diagram can help the environmental manager determine which law applies and under what conditions, and the RCRA corrective action decision flowchart can guide the manager in determining which specific sections of RCRA apply to a RCRA-lead environmental restoration program.

52877 Implementation of an integrated CERCLA-NEPA environmental process at a FUSRAP site. Devgun, J.S. (Argonne National Lab., IL (USA)); Beskid, N.J.; Robertson, R.C.; Atkin, R.G. pp. 549-555 of Waste processing, transportation, storage and disposal, technical programs and public education: Volume 2. Low-level waste. Post, R.G. Arizona Board of Regents, Tucson, AZ (USA) (1989). pp. 844 DOE Contract W-31-109-ENG-38. (CONF-890207–: Waste management '89: 15th international waste management symposium conference, Tucson, AZ (USA), 26 Feb - 2 mar 1989).

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 and it amendment in 1986 through the Superfund Amendments and Reauthorization Act (SARA) have significantly affected the environmental compliance process. Remedial actions at contaminated sites now must satisfy the requirements of not only the National Environmental Policy Act (NEPA) but also CERCLA, as amended. For planning and conducting remedial actions under the Formerly Utilized Sites Remedial Action Program (FUSRAP), the U.S. Department of Energy has developed and implemented an integrated process aimed at satisfying the requirements of both NEPA and CERCLA, as amended. The integrated approach involves a single, comprehensive environmental process that results in a single set of documentation. The process is streamlined, efficient, and cost effective and it minimizes confusion to the public. This paper discusses the need for, and the elements of, the integrated process as applied to FUSRAP sites. The implementation of the process is illustrated through a case study of FUSRAP sites in Tonawanda, New York.

52878 Evaluation of the hydrogeologic system in disposal of mixed wastes. Chia, Y.P. (Argonne National Lab., IL (USA)); Yuan, Y.C.; Yu, C. pp. 535-541 of Waste processing, transportation, storage and disposal, technical programs and public education: Volume 2. Low-level waste. Post, R.G. Arizona Board of Regents, Tucson, AZ (USA) (1989). pp. 844 DOE Contract W-31-109-ENG-38. (CONF-890207–: Waste management '89: 15th international waste management symposium conference, Tucson, AZ (USA), 26 Feb - 2 mar 1989).

Hydrogeologic settings and processes are considered to have a controlling effect on the long-term performance of a multilayered mixed-waste disposal cell. A conceptual modeling of disposal cells indicated that the hydraulic conductivity of the final cover, compared to that of the liner, plays an equal or more important role in determining both the leakage rate from the unit and the breakthrough time. A low water saturation for the disposal facility or a periodic dry condition at the surface can significantly impede downward water infiltration. Analysis also revealed that the emplacement of a disposal cell may cause the water table to shift upward and possibly saturate part of the disposal cell. Seasonal fluctuations of the water table may then carry leachate away from the waste to the aquifer. Therefore, effective design, construction, and monitoring of a mixed-waste disposal cell rely on a comprehensive understanding of infiltration through the land disposal unit and of local hydrogeologic conditions.

52879 X TRAX: An application for mixed waste separation. Padgett, D. (Chem-Nuclear Systems, Inc. (US)); Hollenbeck, P. pp. 519-523 of Waste processing, transportation, storage and disposal, technical programs and public education: Volume 2. Low-level waste. Post, R.G. Arizona Board of Regents, Tucson, AZ (USA) (1989). pp. 844 (CONF-890207–: Waste management '89: 15th international waste management symposium conference, Tucson, AZ (USA), 26 Feb - 2 mar 1989).

This paper discusses the demonstration of a technology for the treatment of certain wastewater sludges. The sludges were a Resource Conservation and Recovery Act (RCRA) hazardous waste which was also contaminated with uranium and other trace radioisotopes. As such, it was classified as a mixed waste and could not be readily dealt with under current disposal criteria. The technology employed in conducting the demonstration consisted of the X*TRAX thermal separation system and stabilization of the treated solids using a cement solidification system. The X*TRAX transportable system is a prototype, five ton per day, indirect fired unit which utilizes a rotary kiln and includes an associated gas handling trailer. Treatment consists of heating the sludge to drive off the volatile organic fraction followed by condensation and collection of the organics as a separate waste stream. Dried, organic free solids

exiting the kiln are still considered hazardous waste due to the presence of toxic, heavy metals.

52880 **DECHEM: A program for characterizing and mitigating chemical contamination at UMTRA project sites.** Reith, C.C. (Jacobs Engineering Group, Inc., Albuquerque, NM (USA)); Meyer, H.R.; Till, J.E.; Matthews, M.L.; Richey, R.H. pp. 585-591 of Waste processing, transportation, storage and disposal, technical programs and public education: Volume 2. Low-level waste. Post, R.G. Arizona Board of Regents, Tucson, AZ (USA) (1989). pp. 844 (CONF-890207–: Waste management '89: 15th international waste management symposium conference, Tucson, AZ (USA), 26 Feb - 2 mar 1989).

This paper reports on the DECHEM method, developed on the Uranium Mill Tailings Remedial Action (UMTRA) Project to guide characterization and remedial planning for heavy metals contamination in soils. This is necessary because metals and metalloids such as arsenic, lead, molybdenum, selenium, uranium, and vanadium that are sometimes associated with the mill tailings may be more mobile than radium-226 (Ra-226), hence may migrate more deeply into subpile soils (beneath tailings that are to be relocated) or into adjacent contaminated materials at UMTRA Project sites. The result is that remedial action to the Ra-226 excavation limit, as specified in the UMTRA Project's authorizing legislation, may not remove all hazardous non-radiological contamination.

52881 **Decontamination of lead by refining bench-scale testing.** Davis, M.V. (Idaho National Engineering Lab., Idaho Falls, ID (USA)). pp. 653-657 of Waste processing, transportation, storage and disposal, technical programs and public education: Volume 2. Low-level waste. Post, R.G. Arizona Board of Regents, Tucson, AZ (USA) (1989). pp. 844 DOE Contract AC07-76ID01570. (CONF-890207–: Waste management '89: 15th international waste management symposium conference, Tucson, AZ (USA), 26 Feb - 2 mar 1989).

This report describes a bench-scale refining test to remove radioactive contamination from lead. The equipment used, the procedures employed, and the results obtained from tests performed at the Idaho National Engineering Laboratory (INEL) are described. Lead is a hazardous material. When it becomes radioactively contaminated and can no longer be used, it is a mixed waste (a waste that is both hazardous and radioactive) and is subject to Environmental Protection Agency (EPA) regulations. These regulations require hazardous waste to be treated prior to disposal. Presently, there is no treatment process that will render lead nonhazardous, nor is there a disposal site that will accept lead as a mixed waste. Decontamination is the only alternative.

52882 **Materials and degradation modes in an alternative LLW disposal facility.** Cowgill, M.G. (Brookhaven National Lab., Upton, NY (USA). Nuclear Energy Dept.); MacKenzie, D.R. pp. 689-696 of Waste processing, transportation, storage and disposal, technical programs and public education: Volume 2. Low-level waste. Post, R.G. Arizona Board of Regents, Tucson, AZ (USA) (1989). pp. 844 (CONF-890207–: Waste management '89: 15th international waste management symposium conference, Tucson, AZ (USA), 26 Feb - 2 mar 1989).

The materials used in the construction of alternative low-level waste disposal facilities will be subject to interaction with both the internal and the external environments associated with the facilities and, unless precautions are taken, may degrade, leading to structural failure. This paper reviews the characteristics of both environments with respect to three alternative disposal concepts, then assesses how reaction with them might affect the properties of the materials, which include concrete, steel-reinforced concrete, structural steel, and various protective coatings and membrances. It is identifies and evaluates the probability of reactions occurring which might lead to degradation of the materials and so compromise the structure. The probability of failure (interpreted relative to the ability of the structure to restrict ingress and egress of water) is assessed for each material and precautionary measures, intended to maximize the durability of the facility, are reviewed.

52883 **Properties of concrete for use in near surface low-level waste disposal facilities.** Rogers, V. (Rogers and Associates Engineering Corp., Salt Lake City, UT (USA)); Shuman, R.; Nielson, K.; Conner, J. pp. 697-700 of Waste processing, transportation, storage and disposal, technical programs and public education: Volume 2. Low-level waste. Post, R.G. Arizona Board of Regents, Tucson, AZ (USA) (1989). pp. 844 (CONF-890207–: Waste management '89: 15th international waste management symposium conference, Tucson, AZ (USA), 26 Feb - 2 mar 1989).

The majority of alternative low-level waste disposal technologies strive to isolate the radioactive waste from the environment through the implementation of engineered man-made barriers. Of the materials used in the construction of these barriers, concrete is, by far, the most prevalent. As alternative facility designs are developed, it will be necessary to assess the features and long-term performance of the technologies. Reliable assessments will depend, in part, on an accurate understanding of the engineered barriers used in construction. Towards these ends an investigation into the properties and behavior of two types of concrete was conducted. Results are presented. Two concrete mix designs were used in the investigation. The first of these employs a Type II cement with a microsilica (silica fume) admixture. The second concrete mix uses a Type V cement with a pozzolan admixture and has approximately four percent entrained air.

52884 **Thorium-230 contamination: Problems in field detection and recent advances.** Noey, K.C. (Bechtel National, Inc., Oak Ridge, TN (USA)); Liedle, S.D.; Hickey, C.R.; Doane, R.W. pp. 615-618 of Waste processing, transportation, storage and disposal, technical programs and public education: Volume 2. Low-level waste. Post, R.G. Arizona Board of Regents, Tucson, AZ (USA) (1989). pp. 844 (CONF-890207–: Waste management '89: 15th international waste management symposium conference, Tucson, AZ (USA), 26 Feb - 2 mar 1989).

The authors are currently performing radiological surveys on approximately ninety properties in the St. Louis, Missouri area as part of the U.S. Department of Energy's Formerly Utilized Sites Remedial Action Program. The properties involved are the St. Louis Airport Site, Latty Avenue Properties, St. Louis Downtown Site, Coldwater Creek, and the associated roads and vicinity properties. The primary radioactive contaminant on these properties is thorium-230. Since field instrumentation is not available to detect the presence of alpha-emitting contamination in soil, soil samples are being collected and sent to an analytical laboratory for analysis. Thorium-230 analysis is costly and time-consuming, and as a result, soil sample analysis results are not available to help direct the field sampling program. This paper provides discussion of the manner in which the properties became radioactively contaminated, followed by a discussion of the difficulties associated with the detection of thorium-230. Finally, new methodologies for detecting alpha-emitting radionuclides in the field are described.

52885 **Safety assessment for a below-ground vault low-level radioactive waste disposal facility.** Merrell, G.B. (Rogers and Associates Engineering Corp., Salt Lake City, UT (USA)); Rogers, V.C.; Conner, J. pp. 723-726 of Waste processing, transportation, storage and disposal, technical programs and public education: Volume 2. Low-level waste. Post, R.G. Arizona Board of Regents, Tucson, AZ (USA) (1989). pp. 844 (CONF-890207–: Waste management '89: 15th international waste management symposium conference, Tucson, AZ (USA), 26 Feb - 2 mar 1989).

This paper reports on a radiological safety assessment performed for a hypothetical below-ground vault radioactive waste disposal facility as part of a prototype license application. The assessment was prepared using guidelines provided by the NRC. The facility design incorporates different concrete vault designs for the Class A and Class B/C wastes. The facility is located in a humid environment with relatively permeable soil. Doses were calculated for a variety of environmental exposure pathways, including ground water, surface water, and atmospheric transport. The doses were calculated for workers at the site and for members of the public residing near the site. Doses were also calculated for a reclaimer who inadvertently enters the site after institutional control of the site has ended. The projected doses were found to meet all current regulatory requirements.

52886 **Emergency avoidance solidification campaign of liquid low-level waste at the Melton Valley Storage Tank Facility.** Hodges, S.M. Jr. (LN Technologies Corp., Columbia, SC (USA));

Denault, R.P. pp. 751-755 of Waste processing, transportation, storage and disposal, technical programs and public education: Volume 2. Low-level waste. Post, R.G. Arizona Board of Regents, Tucson, AZ (USA) (1989). pp. 844 (CONF-890207–: Waste management '89: 15th international waste management symposium conference, Tucson, AZ (USA), 26 Feb - 2 mar 1989).

Radioactive liquid low-level (supernate) waste at the Oak Ridge National Laboratory (ORNL) is collected and stored in eight 50,000 gallon tanks at the Melton Valley Storage Tank (MVST) Facility. The waste generation rate at ORNL is such that periodic waste processing is needed to ensure that space is always available for the wastes solution produced from research and development laboratories, radiochemical pilot plants and nuclear reactors located at ORNL. These periodic efforts are called emergency avoidance solidification campaigns. In the past, the stored liquid waste was mixed with grout and injected into deep wells at the New Hydrofracture Facility. The deep well injections are no longer being performed. Stabilization and shallow land burial was chosen as the disposal method for this waste. This paper discusses the waste form certification of the supernate waste. Criterion for the waste form certification included successful completion of 10CFR61 testing. This paper describes the actual solidification of the supernate waste.

52887 **Stability analysis of earth mounded concrete bunker disposal system.** Liu, P. (Ebasco Services, Inc., New York, NY (USA)). pp. 771-774 of Waste processing, transportation, storage and disposal, technical programs and public education: Volume 2. Low-level waste. Post, R.G. Arizona Board of Regents, Tucson, AZ (USA) (1989). pp. 844 (CONF-890207–: Waste management '89: 15th international waste management symposium conference, Tucson, AZ (USA), 26 Feb - 2 mar 1989).

The DOE/EG and GI commissioned the development of a preliminary design of an Americanized version of the Earth-Mounded Concrete Bunker (EMCB) LLW disposal concept. The project objective was to develop the technical analysis portion of a prototype license application (PLA) for a LLW disposal facility (i.e., NUREG-1199). The PLA provides an appropriate vehicle which to solicit NRC comments on identifying the principal licensing issues related to LLW disposal in engineered structures. This paper describes the engineering stability analyses performed on the EMCB concept for structural stability, slope stability, and settlement.

52888 **Variation in runoff and erosion rates from different trench cap cover systems.** Lopez, E.A. (Los Alamos National Lab., NM (USA)); Barnes, F.J.; Kincaid, M.L.; Antonio, E.J. pp. 765-769 of Waste processing, transportation, storage and disposal, technical programs and public education: Volume 2. Low-level waste. Post, R.G. Arizona Board of Regents, Tucson, AZ (USA) (1989). pp. 844 (CONF-890207–: Waste management '89: 15th international waste management symposium conference, Tucson, AZ (USA), 26 Feb - 2 mar 1989).

A field-scale demonstration study was established at Los Alamos national Laboratory to evaluate the interactive effects of soil surface mulches and type of vegetative cover onsite water balance and erosion under natural precipitation conditions. The study was established in 1987 on an inactive, low-level radioactive waste site, and consists of clusters of plots on 3 different soil profiles. Each cluster consists of two pairs of plots. Each pair of plots has either shrub or grass vegetative cover, and one plot of each pair received a gravel surface mulch at the time of installation. Soil moisture was measured biweekly, and plant and soil surface cover were measured seasonally. Total runoff and sediment transport from each plot was measured after each precipitation event or each snowmelt event. Data show increase stabilization of the soil surface with time.

52889 **Flow and transport of radionuclides in unsaturted fractured basalt.** Walton, J.C. (Idaho National Engineering Lab., Idaho Falls, ID (USA)); Baca, R.G.; Rasmussen, T.L. pp. 775-780 of Waste processing, transportation, storage and disposal, technical programs and public education: Volume 2. Low-level waste. Post, R.G. Arizona Board of Regents, Tucson, AZ (USA) (1989). pp. 844 DOE Contract AC07-76ID01570. (CONF-890207–: Waste management '89: 15th international waste management symposium conference, Tucson, AZ (USA), 26 Feb - 2 mar 1989).

A modeling analysis of radionuclide transport in the vadose zone is described. The central focus of the modeling is to develop an understanding of the nature of flow and transport at the site of concern. Characterization of the site is still incomplete, including the presence of perched water, and observed contaminant migration. The problem of modeling fluid flow and transport processes is made difficult by the alternate layers of sedimentary materials and fractured basalts that characterize the geologic setting. The modeling results give qualitative agreement with monitoring data from the site suggesting that fracture flow is an important component of the flow system.

52890 **Sensitivity analysis of maximum doses for a below-ground vault low-level radioactive waste disposal facility.** Merrell, G.B. (Rogers and Associates Engineering Corp., Salt Lake City, UT (USA)); Rogers, V.C.; Conner, J. pp. 727-734 of Waste processing, transportation, storage and disposal, technical programs and public education: Volume 2. Low-level waste. Post, R.G. Arizona Board of Regents, Tucson, AZ (USA) (1989). pp. 844 (CONF-890207–: Waste management '89: 15th international waste management symposium conference, Tucson, AZ (USA), 26 Feb - 2 mar 1989).

This paper reports on a radionuclide migration analysis performed for a hypothetical below-ground vault radioactive waste disposal facility as part of a prototype license application. The facility design incorporated different concrete vault designs for the Class A and Class B/C wastes. The facility was located in a humid environment with relatively permeable soil. Doses were calculated for an individual using well water at the site boundary. Parameters of interest for the sensitivity study were the quantity of water percolating through the cover, the permeability of the native soil, and the subsurface concentrations of chemical affecting concrete degradation. Variation of the water percolation rate to simulate failure of the cover system resulted in peak doses which were a factor of 2.7 larger than for the base case. A factor of ten variation in the natural soil permeability also resulted in a factor of 2.7 increase in the maximum dose. Variations in the subsurface concentration of sulfate ion had little effect on the magnitude of the groundwater doses, but affected the longevity of the concrete structures. Having different failure times for the Class A and Class B/C disposal vaults was shown to be beneficial.

52891 **Brine migration in a salt repository.** Hwang, Y. (Lawrence Berkeley Lab., CA (USA). Earth Sciences Div.); Chambre, P.L.; Pigford, T.H.; Lee, W.W. *Nuclear Technology (USA)*, 90(2): 205-214 (May 1990). DOE Contract AC03-76SF00098.

The possible role of brine migration in radionuclide transport in a nuclear waste repository is studied. Mathematical derivation of the analysis is given, along with numerical illustrations using parameter values typical of a nuclear waste repository. For heat-emitting wastes and the parameters studied here, brine migration in salt is minuscule, of the order of micrometers per year, localized within a few meters from the waste package, and highly transient, fading away within a few years of waste emplacement.

0530 Environmental Aspects

Refer also to citation(s) 52784, 52799, 52804, 52816, 52817, 52818, 52819, 52820, 52821, 52822, 52823, 52824, 52825, 52826, 52827, 52828, 52829, 52830, 52831, 52832, 52833, 52834, 52835, 52836, 52837, 52838, 52839, 52840, 52841, 52842, 52856, 52857, 52858, 52867, 52869, 52877, 52878, 52880, 52884, 52885, 52888, 52889, 52890, 52895, 52896, 53043, 53642, 53787

52892 (IPEN-PUB–291) **Environmental monitoring (operational period) of the uranium enrichment facility Almirante Alvaro Alberto. Quadrimonthly report of gamma spectroscopy measurements: march to june 1988.** Venturini, L.; Pecequilo, B.R.S. Instituto de Pesquisas Energeticas e Nucleares (IPEN), Sao Paulo, SP (Brazil). Feb 1990. 20p. (In Portuguese). Order Number DE91605822. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

In this report we present the assessment of the environmental monitoring radiation levels during the operation period of the Uranium Enrichment Facility Almirante Alvaro Alberto from March to

July 1988. The purpose was achieved by sampling and analyzing using gamma spectrometry, water and terrestrial and biological indicators. (author).

0540 Health and Safety

Refer also to citation(s) 52781, 52795, 52811, 52843, 52844, 52855, 52858, 52860, 52864, 52866, 52867, 52880, 52881, 52884, 52885, 52887, 52890, 53063, 53070, 53084, 53085, 53654, 54181

52893 (CNIC-I–004, pp. 118-119) **Gaseous tritium scrubber.** Wei Zengquan; Ma Huifang; Wu Dingqing. China Nuclear Information Centre, Beijing, BJ (China); Academia Sinica, Lanzhou, GS (China). Inst. of Modern Physics. Jun 1990. In *IMP annual report, 1988 (January-December).* 138p. Order Number DE91606195. Source: NTIS (US Sales Only), PC A07/MF A01; OSTI; INIS.

Published in summary form only. TRITIUM/chemisorption; TRITIUM/scrubbing; CATALYSTS; CONTAMINATION; DECONTAMINATION; OXIDIZERS; TRITIUM; CHEMISORPTION; SCRUBBING

52894 (CNIC-I–004, pp. 119-120) **The calculation of neutron spectrum outside the shielding of K-600 neutron generator.** Wei Zengquan. China Nuclear Information Centre, Beijing, BJ (China); Academia Sinica, Lanzhou, GS (China). Inst. of Modern Physics. Jun 1990. In *IMP annual report, 1988 (January-December).* 138p. Order Number DE91606195. Source: NTIS (US Sales Only), PC A07/MF A01; OSTI; INIS.

Published in summary form only. NEUTRON SOURCE FACILITIES/neutron spectroscopy; NEUTRON SOURCE FACILITIES/radiation protection; ALGORITHMS; ENERGY LEVELS; MONTE CARLO METHOD; NEUTRONS; SHIELDS

52895 (DOE/EH–0145-Vol.1) **Tiger Team Assessment of the Paducah Gaseous Diffusion Plant: Volume 1.** USDOE Assistant Secretary for Environment, Safety and Health, Washington, DC (USA). Jul 1990. 377p. Sponsored by U.S. DOE Environment Health & Safety. Order Number DE91000472. Source: NTIS, PC A17/MF A01 - OSTI; GPO Dep.

This document contains findings and concerns identified during the Tiger Team Assessment of the Department of Energy's (DOE) Paducah Gaseous Diffusion Plant (PGDP) in Paducah, Kentucky. The assessment was directed by the Department's Office of Environment, Safety and Health (ES&H) and was conducted from June 18 to July 20, 1990. The PGDP Tiger Team Assessment is comprehensive in scope. It covers the Environmental, Safety and Health (including OSHA Compliance), and Management areas and determines the site's compliance with applicable federal (including DOE), state, and local regulations and requirements. The objective of the assessment program is to provide the Secretary with information on the current ES&H compliance status of DOE facilities, root causation for noncompliance, adequacy of DOE and site contractor ES&H management programs, response actions to address the identified problem areas, and DOE-wide ES&H compliance trends and root causes.

52896 (DOE/EH–0145-Vol.2) **Tiger Team Assessment of the Paducah Gaseous Diffusion Plant: Volume 2, Appendices.** USDOE Assistant Secretary for Environment, Safety and Health, Washington, DC (USA). Jul 1990. 480p. Sponsored by U.S. DOE Environment Health & Safety. Order Number DE91000493. Source: NTIS, PC A21/MF A01 - OSTI; GPO Dep.

This document contains findings and concerns identified during the Tiger Team Assessment of the Department of Energy's (DOE's) Paducah Gaseous Diffusion Plant (PGDP) in Paducah, Kentucky. The assessment was directed by the Department's Office of Environment, Safety and Health (ES&H) and was conducted from June 18 to July 20, 1990. The PGDP Tiger Team Assessment is comprehensive in scope. It covers the Environmental, Safety and Health (including OSHA Compliance), and Management areas and determines the site's compliance with applicable federal (including DOE), state, and local regulations and requirements. The objective of the assessment program is to provide the Secretary with information on the current ES&H compliance status of DOE facilities, root causation for noncompliance, adequacy of DOE and site contractor ES&H management programs, response actions to address the identified problem areas, and DOE-wide ES&H compliance trends and root causes. This volume contains appendices.

52897 (LA–11939-MS) **PF-4 simulated fire accident analysis: Filter-spray cool-down system reevaluation implications.** White, B.W.; Gregory, W.S. Los Alamos National Lab., NM (USA). Oct 1990. 57p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-36. Order Number DE91000888. Source: NTIS, PC A04/MF A01 - OSTI; GPO Dep.

The Los Alamos National Laboratory PF-4 facility was designed with spray cool down systems within the building's ventilation systems. The Engineering and Safety Analysis Group was asked, in cooperation with ENG-8 and MST-8, to evaluate whether the spray cool-down system still need to be classified as "safety class" systems. The study was performed using the FIRAC computer code. Given the fire source terms (hypothetical fire energy or time-temperature history), FIRAC can predict the pertinent transient flow parameters (pressures, flows, and temperatures) throughout a previously defined and selected fire zone. A computer model for the study that had all of the main ventilation systems in the south half of the PF-4 facility was used. Because the most hazardous room is located in the 400 Section, all ventilation systems but the 400 Section's one were simplified. The impetus for simplification was to keep the computer model tractable, and this was possible with the following assumptions: the fire cannot spread from one room to another, all corridor connecting doors are closed and will not fail under the pressures generated by the fire, and the principal pathway for potential release is the ventilation system. All of the blowers continue to operate, and all fire retardant systems fail to operate during the fire. The ASTM time-temperature curve was the source for the burn-room temperature, and smoke injection was used as input as well. Five different computer runs were made using different combinations of source terms and heat transfer. A connection from the burn room to the glovebox ventilation system was created by burning the glovebox plastic shielding; it was modeled by a branch having an initial flow 75 ft^3/min. 7 refs., 35 refs., 15 tabs.

52898 (RFP–4444) **The use of the case study method in radiation worker continuing training.** Stevens, R.D. EG and G Rocky Flats, Inc., Golden, CO (USA). [1990]. 23p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC34-90DP62349. (CONF-9010208–2-Draft: 14. annual TRADE conference, Denver, CO (USA), 22-24 Oct 1990). Order Number DE91000999. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Typical methods of continuing training are often viewed by employees as boring, redundant and unnecessary. It is hoped that the operating experience lesson in the required course, Radiation Worker Requalification, will be well received by employees because actual RFP events will be presented as case studies. The interactive learning atmosphere created by the case study method stimulates discussion, develops analytical abilities, and motivates employees to use lessons learned in the workplace. This problem solving approach to continuing training incorporates cause and effect analysis, a technique which is also used at RFP to investigate events. A method of designing the operating experience lesson in the Radiation Worker Requalification course is described in this paper. 7 refs., 2 figs.

52899 (WHC-EP–0377-Rev.1) **Safety improvement plan: Hydrogen in waste tanks: Revision 1.** Westinghouse Hanford Co., Richland, WA (USA). Sep 1990. 79p. Sponsored by U.S. DOE Office of Environmental Restoration and Waste Management. DOE Contract AC06-87RL10930. Order Number DE91001287. Source: NTIS, PC A05/MF A01 - OSTI; GPO Dep.

There are 161 waste tanks located in tank farms in the 200 East and West Areas on the Hanford Site ranging in capacity from approximately 500,000 to 1,000,000 gal and another 16 tanks have a capacity of 55,000 gal. The hazards associated with radioactive waste storage demand continuous review. In March of 1990 the potential for a large quantity of hydrogen and nitrous oxide to exist as an explosive mixture within the waste was declared an unreviewed safety question. The Waste Tank Safety Task Team was established in late March to carry out safety evaluations and plan the means of mitigating the hydrogen hazard. Action was promptly taken to identify the tanks with the highest hazard and to implement interim operating requirements to minimize ignition sources.

Work in and around the 23 tanks identified now requires special training, special tools, special supervision, and, for nonroutine activity, an exhaustive safety analysis and high-level authorization. The scope of this plan includes work to evaluate the hazard of the hydrogen and nitrous oxide mixture, identify the means to mitigate this hazard, and implement the mitigations. The scope also includes gathering and analyzing information about the wastes and waste tanks to ensure that the hazard is fully understood, that the means of mitigation will be productive, and that the mitigation will be effectively implemented. 4 refs., 15 figs., 4 tabs.

0550 Safeguards, Inspection, and Accountability

Refer also to citation(s) 52779, 52784, 52851, 52856, 52877, 52898, 54391

52900 (NBL–316) **The production and certification of a plutonium equal-atom reference material: NBL CRM 128.** Crawford, D.W. (Department of Energy, Washington, DC (USA). Office of Safeguards and Security); Gradle, C.G.; Soriano, M.D. USDOE New Brunswick Lab., Argonne, IL (USA). Jul 1990. 112p. Sponsored by U.S. DOE Office of Administration and Human Resource Management. Order Number DE91000584. Source: NTIS, PC A06/MF A01; OSTI; INIS; GPO Dep.

This report describes the design, production, and certification of the New Brunswick Laboratory plutonium equal-atom certified reference material (CRM), NBL CRM 128. The primary use of this CRM is for the determination of bias corrections encountered in the operation of a mass spectrometer. This reference material is available to the US Department of Energy contractor-operated and government-operated laboratories, as well as to the international nuclear safeguards community. The absolute, or unbiased, certified value for the CRM's Pu-242/Pu-239 ratio is 1.00063 ± 0.00026 (95% confidence interval) as of October 1, 1984. This value was obtained through the quantitative blending of high-purity, chemically and isotopically characterized separated isotopes, as well as through intercomparisons of CRM samples with calibration mixtures using thermal ionization mass spectrometry. 32 tabs.

52901 (SAND–90-1719) **Metal detector technology data base.** Porter, L.K.; Gallo, L.R.; Murray, D.W. Sandia National Labs., Albuquerque, NM (USA). Aug 1990. 52p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC04-76DP00789. Order Number DE91000092. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The tests described in this report were conducted to obtain information on the effects target characteristics have on portal type metal detector response. A second purpose of the tests was to determine the effect of detector type and settings on the detection of the targets. Although in some cases comparison performance of different types and makes of metal detectors is found herein, that is not the primary purpose of the report. Further, because of the many variables that affect metal detector performance, the information presented can be used only in a general way. The results of these tests can show general trends in metal detection, but do little for making accurate predictions as to metal detector response to a target with a complex shape such as a handgun. The shape of an object and its specific metal content (both type and treatment) can have a significant influence on detection. Thus it should not be surprising that levels of detection for a small 100g stainless steel handgun are considerably different than for detection of the 100g stainless steel right circular cylinder that was used in these tests. 7 figs., 1 tab.

52902 (SAND–90-1824) **Vindicator ETW-250 test report.** Greer, G.S. Sandia National Labs., Albuquerque, NM (USA). May 1990. 27p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC04-76DP00789. Order Number DE91000086. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The Vindicator ETW-250 taut wire system combines a physical taut wire barrier with an intrusion detection sensor network. The sensor wires deter and/or slow physical entry into protected areas. The sensors themselves generate an alarm if the sensor wires are pulled, spread, cut, or climbed on. This physical motion is converted into an electrical waveform that is analyzed by the processor. The processor then determines if this motion is within the pre-programmed parameters. If it is not, an alarm is generated through a relay back to the monitoring station. Small changes, such as those caused by temperature, are rejected. Installation and testing are described.

0560 Legislation and Regulations

Refer also to citation(s) 52855, 52858, 52860, 52863, 52864, 52865, 52866, 52870, 52871, 52872, 52876, 52877, 52879, 52881, 52885, 52887, 53025, 53107

07 ISOTOPE AND RADIATION SOURCE TECHNOLOGY

0702 Radiation Sources

Refer also to citation(s) 53048, 53241, 53242, 53328, 53331, 53352, 53572, 53959, 54168, 54169, 54283, 54372

52903 (CNIC-I–004, pp. 92-93) **A freeman II ion source.** Liang Zongli; Bai Dongying; Xiao Zongli. China Nuclear Information Centre, Beijing, BJ (China); Academia Sinica, Lanzhou, GS (China). Inst. of Modern Physics. Jun 1990. In *IMP annual report, 1988 (January-December).* 138p. Order Number DE91606195. Source: NTIS (US Sales Only), PC A07/MF A01; OSTI; INIS.

Published in summary form only. ION SOURCES/modifications; ARGON 33; BEAM CURRENTS; BORON 11; ION BEAMS; MODIFICATIONS; MASS SPECTRA; NITROGEN 14; SPECIFICATIONS

52904 (LA–11933-PR) **The Manuel Lujan, Jr. Neutron Scattering Center LANSCE experiment reports 1989 run cycle: Progress report.** Hyer, D.K.; DiStravolo, M.A. (comps.). Los Alamos National Lab., NM (USA). Oct 1990. 265p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-36. Order Number DE91000513. Source: NTIS, PC A12/MF A01; OSTI; INIS; GPO Dep.

This report contains a listing and description of experiments carried on at the LANSCE neutron scattering facility in the following areas: High Density Powder Diffraction; Neutron Powder Diffractometer, (NPD); Single Crystal Diffractometer, (SCD); Low-Q Diffractometer, (LQD); Surface Profile Analysis Reflectometer, (SPEAR); Filter Difference Spectrometer, (FDS); and Constant-Q Spectrometer.

52905 (ORNL–6618) **Advanced Neutron Source Cross Section Libraries (ANSL-V): ENDF/B-V based multigroup cross-section libraries for advanced neutron source (ANS) reactor studies.** Ford, W.E. III; Arwood, J.W.; Greene, N.M.; Moses, D.L.; Petrie, L.M.; Primm, R.T. III; Slater, C.O.; Westfall, R.M.; Wright, R.Q. Oak Ridge National Lab., TN (USA). Sep 1990. 116p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE91000545. Source: NTIS, PC A06/MF A01; OSTI; INIS; GPO Dep.

Pseudo-problem-independent, multigroup cross-section libraries were generated to support Advanced Neutron Source (ANS) Reactor design studies. The ANS is a proposed reactor which would be fueled with highly enriched uranium and cooled with heavy water. The libraries, designated ANSL-V (Advanced Neutron Source Cross Section Libraries based on ENDF/B-V), are data bases in AMPX master format for subsequent generation of problem-dependent cross-sections for use with codes such as KENO, ANISN, XSDRNPM, VENTURE, DOT, DORT, TORT, and MORSE. Included in ANSL-V are 99-group and 39-group neutron, 39-neutron-group 44-gamma-ray-group secondary gamma-ray production (SGRP), 44-group gamma-ray interaction (GRI), and coupled, 39-neutron group 44-gamma-ray group (CNG) cross-section libraries. The neutron and SGRP libraries were generated primarily from ENDF/B-V data; the GRI library was generated from DLC-99/HUGO data, which is recognized as the ENDF/B-V photon interaction data. Modules from the AMPX and NJOY systems were used to process the multigroup data. Validity of selected data from the fine- and broad-group neutron libraries was satisfactorily tested in performance parameter calculations.

52906 (SAND–90-2217C) **Solid state radioluminescent sources using zeolites.** Gill, J.T. (EG and G Mound Applied Technologies, Miamisburg, OH (USA)); Hawkins, D.B.; Renschler, C.L. Sandia National Labs., Albuquerque, NM (USA). [1990]. 6p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789 ;AC04-88DP43495. (CONF-9009201–5: Radioluminescent technology conference, Annapolis, MD (USA), 25-26 Sep 1990). Order Number DE90017594. Source: NTIS, PC A02/MF A01 - OSTI.

Inorganic zeolites show promise as an alternative to traditional tritium gas tube light sources. Greater proximity of tritium atoms and luminescing centers, as well as greater tritium loading density, have been obtained within the zeolite aluminosilicate matrix. Zeolites are in addition optically clear and radiation stable. The zeolite radioluminescence program is described. Procedures for obtaining light sources are presented and results are discussed. 12 refs., 1 fig.

0705 Health and Safety

Refer also to citation(s) 53084, 53587

08 HYDROGEN

Refer also to citation(s) 53645

0801 Production

Refer also to citation(s) 52636

0802 Storage, Transport, and Handling

Refer also to citation(s) 52931

09 BIOMASS FUELS

0907 Resources

Refer also to citation(s) 52911, 52915, 52918

52907 (ORNL/TM–11615) **Evaluation of the potential for using old-field vegetation as an energy feedstock: Biomass yield, chemical composition, environmental concerns, and economics.** Johnston, J.W. Jr. Oak Ridge National Lab., TN (USA). Jul 1990. 135p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC05-84OR21400. Order Number DE91000548. Source: NTIS, PC A07/MF A01 - OSTI; GPO Dep.

Environmental Sciences Division Publication No. 3544.

The major focus of current research on production of biomass for use as energy feedstock involves selection of species and genotypes best suited for specific regions of the United States and development of crop management techniques that maximize biomass productivity while minimizing environmental impacts and economic costs. The two experimental sites, and abandoned soybean field (AS) and an abandoned pasture (AP) were studied. At the AS site, the effects of two harvest frequencies (1 or 2 harvests annually), two nitrogen fertilizer treatments (1 or 2 harvests annually), two nitrogen fertilizer treatments (0 or 87 $kg \cdot ha^{-1} \cdot yr^{-1}$), and two phosphorous fertilizer treatments (0 or 111 $kg \cdot ha^{-1} \cdot yr^{-1}$) were determined. At the AP site, the effects of two harvest treatments (1 or 2 harvests annually), two fertilizer treatments (56:56:135 kg of $N:P:K \cdot ha^{-1} \cdot yr^{-1}$), and two lime treatments (0 or 4600 $kg \cdot ha^{-1} \cdot yr^{-1}$) were determined. At both sites, treatments were arranged in a randomized complete block 2 x 2 x 2 factorial experiment. The results of this research indicated that old-field vegetation is: (1) sufficiently productive to provide significant quantities of energy feedstock; (2) chemically suitable as an energy feedstock; (3) environmentally benign with respect to impacts related to soil erosion and nutrient depletion; (4) relatively unresponsive to fertilizer and lime inputs; and (5) economically competitive with other biomass energy feedstock candidates. 38 refs., 8 figs., 68 tabs.

0908 Production

Refer also to citation(s) 53178

52908 (FRNC-TH–3079) **Study of the mechanism of biosynthesis of non terpenic hydrocarbons in green alga Botryococcus braunii: Synthesis of labelled intermediates.** Mong-Sin, T.P. Paris-6 Univ., 75 (France). 1985. 258p. (In French). Order Number DE88751889. Source: NTIS (US Sales Only), PC A12/MF A01 - OSTI.

In order to demonstrate the mechanism of elongation-decarboxylation in the development of hydrocarbons of the Botryococcus braunii algae, various radioactive substrates with very long chain have been synthetized: C28 ester, C28 beta-cetoester, C28, C30 and C32 beta-hydroxyesters, all of them including a double linkage in position 9 to the methyl. Their incubation with B. braunii resulted in a more efficient incorporation of the C28 beta-hydroxyl compound in the hydrocarbons (better than C28 ester and C28 ceto-ester) and an equivalent yield in the case of superiors homologs (beta-OH in C30 and C32).

52909 (TYOT-JULK–314) **Harvesting and use of wood chips on Finnish farms.** Solmio, H. Tyotehoseuran Julkaisuja, Helsinki (Finland). 1990. 138p. (In Finnish). Project KTM-190/881/86. Order Number DE91707454. Source: NTIS (US Sales Only), PC A07/MF A01.

This study conducted by the Work Efficiency Institute's Forestry Department clarified the situation regarding the methods and equipment used in the harvesting, storing, drying and use of wood chips on farms in 1987. Estimates were also made as to the development of volumes used and the number of farms using wood chips as their source of heating energy. The study was conducted in the form of a mailed questionnaire addressed to farms using wood chips. The mailed questionnaire was targeted at farms included among the National Board of Agriculture's sample farms on which wood chips had been used in 1985. Acceptable responses were obtained from 402 farms. Expansion coefficients were used to enlarge the sample to correspond to the basic population when computing the number of farms using wood chips, the volumes of chips used and distributions of central significance. The basic population consisted of 4 400 farms using wood chips; these farms used 363 000 m^3 of wood chips during the heating season 1986-87. Blower drying of chips was in use on 43% of the basic population's chip farms. In southern Finland, 60% of the farms were provided with a chip dryer. On nearly all of the farms, the farmhouse was heated using chips. On more than half of the basic population's chip farms, the production buildings, too, were heated using chips. Under-burning boilers without a feeding device were in use on more than half of the farms. On more than a 30% of the farms there was a chip burner, a little over 10% of the farms had a pre-furnace boiler and less than 10% of the farms had a chip feeder device. The most frequent heating problems were the difficulty in heating on a small flame, the forming of cavities in the combustion chamber and the entry of smoke into rooms. Of those who responded to the questionnaire, 70% were satisfied with chip heating and 165 were dissatisfied.

52910 **Economic evaluations of optimum rotation age for SRIC plantations.** Strauss, C.H. (School of Forest Resources, Pennsylvania State Univ., University Park, PA (US)); Grado, S.C.; Blankenhorn, P.R.; Bowersox, T.W. pp. 295-308 of Energy from biomass and wastes XIII. Klass, D.L. Institute of Gas Technology, Chicago, IL (USA) (1989). pp. 1378 (CONF-890236–: 13. annual conference on energy from biomass and wastes, New Orleans, LA (USA), 13-17 Feb 1989).

A series of hybrid poplar SRIC plantations established in central Pennsylvania were analyzed to determine their economic optimum rotation age. The general management design for the plantations used fertilized and non-fertilized strategies, a tree spacing of .48 m^2 and a rotation length of 4 years. Analysis of the first two rotations has indicated that the minimum unit cost for fertilized and non-fertilized strategies was in the fourth year of the first rotation and the third year of the second rotation. Growth curves for the rotations show a maximum volume production at the same points in the rotations.

52911 **Accelerating energy crop growth via genetic techniques.** Layton, P.A. (Environmental Sciences Div., Oak Ridge National Lab., Oak Ridge, TN (US)); Wright, L.L.; Ranney, J.W.; Cushman, J.H.; Doyle, T.W.; Turhollow, A.F.; Johnston, J.W. pp. 397-424 of Energy from biomass and wastes XIII. Klass, D.L. Institute of Gas Technology, Chicago, IL (USA) (1989). pp. 1378 DOE Contract AC05-84OR21400. (CONF-890236–: 13. annual conference on energy from biomass and wastes, New Orleans, LA (USA), 13-17 Feb 1989).

The Short Rotation Woody Crops (SRWCP) and Herbaceous Energy Crops (HECP) Programs at Oak Ridge National Laboratory support research on forest and agronomic crops that can be used as feedstocks for the production of biofuels. Reduction of feedstock costs is necessary, and genetic techniques can be used to increase productivity, thereby lowering costs. This paper reports how the SRWCP is currently performing genetic improvement research on five tree species and has inserted genes for herbicide tolerance into a hybrid poplar clone.

52912 **Commercialization of short-rotation intensive-culture tree production in North America.** Wright, L.L. (Environmental Sciences Div., Oak Ridge National Lab., Oak Ridge, TN (US)). pp. 309-328 of Energy from biomass and wastes XIII. Klass, D.L. Institute of Gas Technology, Chicago, IL (USA) (1989). pp. 1378 DOE Contract AC05-84OR21400. (CONF-890236–: 13. annual conference on energy from biomass and wastes, New Orleans, LA (USA), 13-17 Feb 1989).

This paper reports that an estimated 7500 ha of short-rotation intensive culture (SRIC) plantations are now in full-scale production or in scale-up research trials in the United States (4600 ha) and Canada (2900 ha). Eighteen locations in North America have or are planning SRIC plantations of greater than 20 ha in size. A key to commercialization has been the establishment of an alliance between industry and research organizations (usually supported by government programs).

0909 Processing

Refer also to citation(s) 52615, 52930, 53138, 53178

52913 (CONF-900512–4) **Introduction and session summaries for the proceedings of the twelfth symposium on biotechnology fuels and chemicals.** Greenbaum, E. (Oak Ridge National Lab., TN (USA)); Wyman, C.E. Oak Ridge National Lab., TN (USA). [1990]. 8p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC05-84OR21400. From 12. symposium on biotechnology fuels and chemicals; Gatlinburg, TN (USA); 7-11 May 1990. Order Number DE91001490. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

This Twelfth Symposium on Biotechnology for Fuels and Chemicals continues to provide an annual forum for researchers from industry, universities, and government laboratories to exchange information on recent developments in emerging bioprocessing technologies. As in the past, innovative processing concepts are stressed that are in the early stages of development. The meeting began with a session on Thermal, Chemical, and Biological Processing, followed by two sessions on Applied Biological Research. Next, topics in Bioengineering Research were presented, and a special session on Biotechnology, Bioengineering, and the Solution of Environmental Problems concluded the Twelfth Symposium. Both presentations and posters provided information exchange among meeting participants, and several discussion groups were organized to consider special topics of interest to the meeting participants. This paper presents a brief description of the discussions.

52914 (ORNL–6625) **Short rotation Wood Crops Program: Annual progress report for 1989.** Wright, L.L.; Ehrenshaft, A.R. Oak Ridge National Lab., TN (USA). Aug 1990. 113p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC05-84OR21400. Order Number DE91001012. Source: NTIS, PC A06/MF A01 - OSTI; GPO Dep.

Environnemtnal Sciences Division Publication No. 3484.

This report synthesizes the technical progress of research projects in the Short Rotation Woody Crops Program for the year ending September 30, 1989. The primary goal of this research program, sponsored by the US Department of Energy's Biofuels and Municipal Waste Technology Division, is the development of a viable technology for producing renewable feedstocks for conversion to biofuels. One of the more significant accomplishments was the documentation that short-rotation woody crops total delivered costs could be $40/Mg or less under optimistic but attainable conditions. By taking advantage of federal subsidies such as those offered under the Conservation Reserve Program, wood energy feedstock costs could be lower. Genetic improvement studies are broadening species performance within geographic regions and under less-than-optimum site conditions. Advances in physiological research are identifying key characteristics of species productivity and response to nutrient applications. Recent developments utilizing biotechnology have achieved success in cell and tissue culture, somaclonal variation, and gene-insertion studies. Productivity gains have been realized with advanced cultural studies of spacing, coppice, and mixed-species trials. 8 figs., 20 tabs.

52915 (ORNL/Sub–88-SC006/1) **Modifying woody plants for efficient conversion to liquid and gaseous fuels.** Dinus, R.J. (Institute of Paper Science and Technology, Atlanta, GA (USA)); Dimmel, D.R.; Feirer, R.P.; Johnson, M.A.; Malcolm, E.W. Oak Ridge National Lab., TN (USA); Institute of Paper Science and Technology, Atlanta, GA (USA). Jul 1990. 92p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC05-84OR21400. Order Number DE91000550. Source: NTIS, PC A05/MF A01 - OSTI; GPO Dep.

The Short Rotation Woody Crop Program (SRWCP), Department of Energy, is developing woody plant species as sources of renewable energy. Much progress has been made in identifying useful species, and testing site adaptability, stand densities, coppicing abilities, rotation lengths, and harvesting systems. Conventional plant breeding and intensive cultural practices have been used to increase above-ground biomass yields. Given these and foreseeable accomplishments, program leaders are now shifting attention to prospects for altering biomass physical and chemical characteristics, and to ways for improving the efficiency with which biomass can be converted to gaseous and liquid fuels. This report provides a review and synthesis of literature concerning the quantity and quality of such characteristics and constituents, and opportunities for manipulating them via conventional selection and breeding and/or molecular biology. Species now used by SRWCP are emphasized, with supporting information drawn from others as needed. Little information was found on silver maple (Acer saccharinum), but general comparisons (Isenberg 1981) suggest composition and behavior similar to those of the other species. Where possible, conclusions concerning means for and feasibility of manipulation are given, along with expected impacts on conversion efficiency. Information is also provided on relationships to other traits, genotype X environment interactions, and potential trade-offs or limitations. Biomass productivity per se is not addressed, except in terms of effects that may by caused by changes in constituent quality and/or quantity. Such effects are noted to the extent they are known or can be estimated. Likely impacts of changes, however effected, on suitability or other uses, e.g., pulp and paper manufacture, are notes. 311 refs., 4 figs., 9 tabs.

52916 (PB–90-263203/XAB) **Impact of toxic organic chemicals on the kinetics of acetoclastic methanogenesis.** Davies-Venn, C.; Young, J.C.; Tabak, H.H. Arkansas Univ., Fayetteville, AR (USA). Dept. of Civil Engineering. 1990. 32p. Grant EPA-R-814488-01-3. Source: NTIS, PC A03/MF A01.

A knowledge of the effect of toxic organic chemicals on the biotransformation characteristics of organic co-substrates is essential for predicting the impact of these chemicals in anaerobic processes. Bench-scale tests were conducted to assess the impact of toxic organic chemicals on the kinetics of acetoclastic methanogenesis and to determine the relationship between kinetic parameters obtained under non-toxic and toxic conditions. A computer model based on a finite difference non-linear least squares algorithm was used to calculate the kinetic parameters by obtaining a best-fit of the experimental data to the Michaelis-Menten substrate utilization model. Resulting kinetic coefficients revealed significant changes in both the maximum rate of acetate conversion, and the half-velocity

coefficient, when using both chlorophenols and chloroanilines. Therefore, mixed inhibition was occurring. However, non-competitive mechanisms predominated with chemicals containing the 2-chloro functional group while competitive mechanisms seemed to predominate with the 3- and 4-chloro functional groups.

52917 **A technical and economic analysis of direct biomass liquefaction.** Elliot, D.C. (Pacific Northwest Lab., Richland, WA (US)); Baker, E.G.; Beckman, D.; Ostman, A.; Solantausta, Y.; Tulenheimo, V.; Gervert, S.B.; Hornell, C. pp. 743-768 of Energy from biomass and wastes XIII. Klass, D.L. Institute of Gas Technology, Chicago, IL (USA) (1989). pp. 1378 (CONF-890236–: 13. annual conference on energy from biomass and wastes, New Orleans, LA (USA), 13-17 Feb 1989).

This paper is based on the results of a technoeconomic assessment of direct biomass liquefaction processes converting wood and peat to gasoline and diesel fuels. The processes chosen for detailed analysis were atmospheric flash pyrolysis (AFP) and liquefaction in pressurized solvent (LIPS). The assessment covered three steps for each process from feed to final product. This assessment shows that AFP is more economical than LIPS both for the production of boiler fuel oil as the primary liquefaction product and for the production of gasoline and diesel fuel products.

52918 **Advances in processes for fermentation ethanol.** Bull, S.R. (Solar Fuels Research Div., Solar Energy Research Institute, Golden, CO (US)). pp. 1263-1280 of Energy from biomass and wastes XIII. Klass, D.L. Institute of Gas Technology, Chicago, IL (USA) (1989). pp. 1378 (CONF-890236–: 13. annual conference on energy from biomass and wastes, New Orleans, LA (USA), 13-17 Feb 1989).

This paper reports on research and development efforts which have concentrated on processes for conversion of lignocellulosic feedstocks to ethanol. Research on acid hydrolysis has been phased out as the potential for enzymatic hydrolysis appears increasingly more promising. Most efforts have been focused on the simultaneous saccharification and fermentation process and means to reduce end-product inhibition of the enzymes. The author discusses the development of a process to ferment ethanol from the xylose fraction of lignocellulose with greater than 70% efficiency.

52919 **Characterization of the extracellular cellulase from a mesophilic Clostridium (strain C7).** Cavedon, K. (Univ. of Massachusetts, Amherst (USA)); Leschine, S.B.; Canale-Parola, E. *Journal of Bacteriology (USA)*, 172(8): 4231-4237 (Aug 1990). DOE Contract FG02-88ER13898.

An extracellular, 700,000-M_r multiprotein complex that catalyzed the hydrolysis of crystalline cellulose (Avicel) was isolated from cultures of Clostridium sp. strain C7, a mesophile from freshwater sediment. In addition to cellulose (Avicel, ball-milled filter paper), the multiprotein complex hydrolyzed carboxymethylcellulose, cellodextrins, xylan, and xylooligosaccharides. Hydrolysis of cellulose or cellotetraose by the complex to yielded cellobiose as the main product. Cellopentaose or cellohexaose was hydrolyzed by the complex to cellotriose or cellotetraose, respectively, in addition to cellobiose. Xylobiose was the main product of xylan hydrolysis, and xylobiose and xylotriose were the major products of xylooligosaccharide hydrolysis. Biochemical and ultrastructural characteristics of the extracellular multienzyme complex are described.

0910 Properties and Composition

Refer also to citation(s) 52907, 52924

0920 Combustion

Refer also to citation(s) 52925, 52927, 53190

52920 (FRNC-TH–3164) **Design, achievement and testing of a waste wood fired-boiler: Contribution to biomass waste upgrading.** Saffar Avval, M. Ecole Nationale Superieure des Arts et Metiers, 75 - Paris (France). 1985. 177p. (In French). Order Number DE88751890. Source: NTIS (US Sales Only), PC A09/MF A01 - OSTI.

A study concerning the wood wastes upgrading through energy conversion is presented. The small wood wastes (chips and sawdust) characteristics are reviewed and the feasibility of a wood wastes boiler is established. The heat transfers in the boiler are modellized and a continuous feeding boiler is designed. An experimental boiler has been constructed and tested and the theoretical and experimental results and performances are compared.

52921 (VTT-SYMP–107, pp. 147-166) **Danish experiences with combustion of low grade fuels.** Kioerboe, K.G. (DK-Teknik, Soeborg (Denmark)). Valtion Teknillinen Tutkimuskeskus, Espoo (Finland). 1989. (CONF-890668–Vol.1: Symposium on low-grade fuels, Helsinki (Finland), 12-16 Jun 1989). In *Low-grade fuels: Volume 1*. 376p. Order Number DE91707607. Source: NTIS (US Sales Only), PC A17/MF A01.

Combustion of straw, wood waste and municipal solid waste has for many years been well-known technology in Denmark. It is expected in the nearest future that new technologies will be introduced for combustion of these biomasses. The extensive testwork performed during the last years on other low grade fuels and wastes, especially industrial wastes, has not yet been commercially applied to a very high degree. However, things take time, but according to the interest found in many organisations and public and private enterprises, several of the research experiences will very likely be commercially utilised in the years to come, not even in Denmark but also abroad.

52922 (VTT-SYMP–107, pp. 373-382) **Operation experiences from bark gasification for a lime kiln.** Siro, M. (Kymmene Corporation, Pietarsaari (Finland). Schauman Pietarsaari Division). Valtion Teknillinen Tutkimuskeskus, Espoo (Finland). 1989. (CONF-890668–Vol.1: Symposium on low-grade fuels, Helsinki (Finland), 12-16 Jun 1989). In *Low-grade fuels: Volume 1*. 376p. Order Number DE91707607. Source: NTIS (US Sales Only), PC A17/MF A01.

Since November 1983 almost all the fuel which is needed for the lime kiln at the Pietarsaari Pulp Mill is produced from wood waste with a Pyroflow-gasifier. In order to reach the flame temperature needed for lime stone calcination, the fuel is dried with flue gases from a recovery boiler. The fluidized bed Pyroflow-gasifier is very easy to control and yields a gas whose the main combustible components are carbon monoxide, hydrogen and methane. The long term availability of the gasifier is 85%, but only one third of the breakdown time is caused by failures in the system. The pay back period was two years.

52923 **Effect of co-combusting refuse-derived fuel and coal on emissions of SO_x, NO_x, and ash from coal-fired boilers.** Norton, G.A. (Ames Lab., Iowa State Univ., Ames, IA (US)); Levine, A.D. pp. 513-528 of Energy from biomass and wastes XIII. Klass, D.L. Institute of Gas Technology, Chicago, IL (USA) (1989). pp. 1378 (CONF-890236–: 13. annual conference on energy from biomass and wastes, New Orleans, LA (USA), 13-17 Feb 1989).

Disposal of municipal solid wastes as fuel supplements in coal-fired power plants is a competitive alternative to landfilling. However, many questions remain unanswered as to the types of emissions produced by co-combusting refuse-derived fuel (RDF) with coal. Combustion and emission data from numerous sites where RDF was co-fired with coal have been compiled and evaluated. Based on evidence extracted from a number of studies, the effect of coal/RDF combustion on emissions is promising. It is clear that more studies are needed to address the issue of emissions, particularly with regard to other pollutants. However, the existing data base suggests that co-combusting RDF with coal is instrumental in reducing emissions of some pollutants from coal-fired power plants.

52924 **Fast pyrolysis of RDF to produce fuel oils, char, and a metal-rich by-product.** Diebold, J. (Solar Energy Research Institute, Golden, CO (US)); Evans, R.; Scahill, J. pp. 851-878 of Energy from biomass and wastes XIII. Klass, D.L. Institute of Gas Technology, Chicago, IL (USA) (1989). pp. 1378 (CONF-890236–: 13. annual conference on energy from biomass and wastes, New Orleans, LA (USA), 13-17 Feb 1989).

The pyrolysis of RDF has been studied at the engineering scale using a vortex pyrolysis reactor to determine the nature of the products and the problems likely to be encountered. Using vortex

pyrolysis reactor, RDF was pyrolyzed and found to produce at least three condensate phases: an asphalt-like tar; a low density waxy material; and a thin aqueous phase. A condensate recovery train was developed specifically to deal with these difficult condensates, which shows initial promise.

0930 Economic, Industrial, and Business Aspects

Refer also to citation(s) 52907, 52910, 52911, 52912, 52914, 52917, 52918, 53178

52925 (TYOT-JULK–312) **Heating devices fired by indigenous fuels as used in detached house: A nation-wide inventory conducted in 1988.** Tuomi, S. Tyotehoseuran Julkaisuja, Helsinki (Finland). 1990. 124p. (In Finnish). Project KTM-9/881/88. Order Number DE91707452. Source: NTIS (US Sales Only), PC A06/MF A01.

This study by the Work Efficiency Institute's Department of Forestry consisted on an inventory of the heating devices fired by indigenous fuels and the heating systems used in detached houses in Finland. The study also included a clarification on the changes made in the heating systems of detached houses in the 1980s and the extent to which heating devices had been used, how house owners acquired their fuelwood and their opinions regarding choice of heating system. The material was collected in the form of a nation-wide mail questionnaire addressed to 7099 owners of detached houses in February-March of 1988. The basic population of 827 300 houses was made up of one and two dwelling detached houses built before 1986. Three out of four detached houses were provided with some kind of wood or peat-fired heating device. On the average, there were 1.6 such heating devices per house. Wood or peat-fired heating devices were more common in newer and older houses. Houses connected to district heating or with oil central heating were more frequently without such a heating device. Of the houses with central heating, less than a third could be heated with only either oil or electricity. More than 50% of them had a preparedness for heating the central heating system with wood, too. Between 1980-1987 the main energy source had been replaced with another one in 8% of the houses. These changes reflected a loss of popularity for oil and wood heating with electricity being the gainer.

52926 **The U.S. Department of Energy alcohol fuel program.** Lindahl, D.M.L. (Office of Alcohol Fuels, U.S. Dept. of Energy, Washington, DC (US)). pp. 63-72 of Energy from biomass and wastes XIII. Klass, D.L. Institute of Gas Technology, Chicago, IL (USA) (1989). pp. 1378 (CONF-890236–: 13. annual conference on energy from biomass and wastes, New Orleans, LA (USA), 13-17 Feb 1989).

The Energy Security Act of 1980 mandated the establishment of the Office of Alcohol Fuels in the Department of Energy on February 14, 1980, to manage the Department of Energy Alcohol Fuels Programs. This paper reports on the program. During its formative years, it was responsible for research, development, engineering, testing, evaluation and demonstration programs that directly supported an alcohol fuels industry. It defined the market and encouraged the development and utilization of alcohol fuels, and developed financial incentives which included grants, loans, and loan guarantees.

0950 Environmental Aspects

Refer also to citation(s) 52907

52927 (DOE/OR/21390–T27) **Phase 1, Background study results under the Council of Great Lake Governors program to perform stack sampling and analysis of emissions from densified refuse derived fuels (d-RDF).** Pacific Environmental Services, Inc., Reston, VA (USA). 7 Apr 1989. 62p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract FG05-83OR21390. Order Number DE91000975. Source: NTIS, PC A04/MF A01 - OSTI; GPO Dep.

This report covers the results of the first part of the study. Chapter 2 contains a summary of the d-RDF literature which was surveyed. Chapter 3 contains a compilation of existing and proposed regulation information from the seven participating Great Lakes States. Chapter 4 includes identification of pellet producers in the region. Chapter 5 contains a description of the pellet producers and test burn facilities selected for the experimental work to be undertaken in the second part of the program study. Chapter 6 contains a list of references. 27 refs., 7 figs., 6 tabs.

0970 Legislation and Regulations

Refer also to citation(s) 52926

0980 Waste Management

Refer also to citation(s) 52909, 52921

10 SYNTHETIC FUELS

1002 Production

Refer also to citation(s) 52632

1005 Transport, Handling, and Storage

Refer also to citation(s) 52650

13 HYDRO ENERGY

1307 Power-Conversion Systems

Refer also to citation(s) 52951

14 SOLAR ENERGY

1403 Economic, Industrial, and Business Aspects

Refer also to citation(s) 52938

1405 Solar Energy Conversion

Refer also to citation(s) 52913, 53479, 53791

52928 (SAND–90-7030) **High-efficiency silicon solar cells for use with a prismatic cover at 160 suns.** Silver, J.R. (Solarex Corp., Rockville, MD (USA)); Patel, B. Sandia National Labs., Albuquerque, NM (USA); Solarex Corp., Rockville, MD (USA). Aerospace Div. Aug 1990. 46p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC04-76DP00789. Order Number DE91000468. Source: NTIS, PC A04/MF A01 - OSTI; GPO Dep.

For this program, Solarex developed a process sequence that could be used in a manufacturing environment to produce high-efficiency silicon concentrator cells. The cells had large gridlines to minimize series resistance losses and a prismatic cover to minimize shadowing. The front surface of the cell was textured to improve absorption of light and passivated to reduce front-surface recombination. Two separate diffusions steps were used: a deep emitter with a light surface concentration and a heavy diffusion to reduce recombination under the front contacts. Cell efficiencies as high as 22.25% were demonstrated at 75 suns and over 21.5% at 150 suns air mass 1.5 illumination. 16 refs., 31 figs., 10 tabs.

52929 (SERI/TP–211-3934) **SERI photovoltaic subcontract reports: Abstracts and document control information, January 1–July 31, 1990.** Solar Energy Research Inst., Golden, CO (USA). Oct 1990. 17p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC02-83CH10093. Order Number DE90000378. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This report contains the document control information and abstracts for SERI Photovoltaic (PV) Program Branch publications

resulting from SERI's subcontracted PV research. The information is presented for reports published or distributed from January 1 through July 31, 1990. In the past, copies of the subcontractor reports were distributed to a broad spectrum of researchers in the field of photovoltaics at a considerable cost to the program. In an attempt to reduce costs and ensure that all researchers receive those current publications that are of specific interest to them, this report will outline these publications, organized by technology, on a regular basis. A list of additional publications and sources is included herein to provide the photovoltaic community with other sources of information. All of the documents represented here are available from the National Technical Information Service (NTIS) and can be purchased using the NTIS order form at the end of this document. Further information on a given subcontracted program may be obtained from the SERI technical monitor identified on each Document Control Page.

52930 (SERI/TP–232-3820) **CO_2 sources for microalgae-based liquid fuel production.** Feinberg, D.; Karpuk, M. Solar Energy Research Inst., Golden, CO (USA). Aug 1990. 35p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC02-83CH10093. Order Number DE90000367. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Researchers in the Aquatic Species Program at the Solar Energy Research Institute are developing species of microalgae that have high percentages of lipids, or oils. These lipids can be extracted and converted to diesel fuel substitutes. Because microalgae need carbon dioxide (CO_2) as a nutrient, optimal microalgae growth occurs in CO_2-saturated solutions. For this reason, the authors of this study sought to identify possible large-scale sources of CO_2 for microalgae-based liquid fuels production. The authors concluded that several such promising sources exist. 42 refs., 14 figs., 10 tabs.

52931 (TKK-F–A657) **Future potential of large-scale grid-connected and hydrogen based photovoltaic power generation in Finland.** Lundstroem, P.; Lund, P.D. Helsinki Univ. of Technology, Otaniemi (Finland). Dept. of Technical Physics. 1989. 56p. Order Number DE91707481. Source: NTIS (US Sales Only), PC A04/MF A01.

This paper describes a pre-feasibility assessment on the potential of large-scale photovoltaic power generation in Finland ranging in time from 1990 up to 2020 and on the possibility of converting solar electricity into hydrogen to provide energy storage and transmission. Special attention is paid to the possible use of existing natural gas facilities for hydrogen or for a mixture of natural gas and hydrogen. The future development of thin-film solar cells, e.g. amorphous silicon, is regarded as a highly potential field. At present, a-Si shows conversion efficiencies of 5-7% and a cost of about dollars 1.6/W_p to manufacture. Manufacturers project that by the turn of the century, or shortly thereafter, 12-18% efficient PV-modules at a price of dollars 0.20-0.40/W_p could be feasible. Photovoltaic electricity production is practically non-polluting and based on a renewable energy source. Because the amount of generated electricity follows the variations of the solar insolation, the storage of electricity becomes a central problem. A possible solution to this is to convert electricity into hydrogen through electrolysis and to use hydrogen as an energy carrier. Hydrogen has many desirable properties as a fuel. It is light and clean and it can be converted into other forms of energy more efficiently than other fuels. The paper starts with an extensive survey on international activities in the PV-hydrogen technology supplemented by a review on future prospects in photovoltaic technology and hydrogen energy systems. These are followed by detailed scenarios on the potential of large-scale PV-technology in the future Finnish energy supply system.

52932 **Modeling of two-junction, series-connected tandem solar cells using top-cell thickness as an adjustable parameter.** Kurtz, S.R. (Solar Energy Research Institute, 1617 Cole Boulevard, Golden, Colorado 80401 (USA)); Faine, P.; Olson, J.M. *Journal of Applied Physics (USA)*, 68(4): 1890-1895 (15 Aug 1990).

Theoretical efficiencies are calculated for two-junction, series-connected solar cells using air mass 1.5 global and direct irradiance spectra. For band-gap combinations previously limited by a low bottom-cell current, thinning of the top cell is shown to result in significant increases in the theoretical efficiencies. The increases are primarily due to increased short-circuit currents, since current matching is achievable. Smaller gains are also seen in the open-circuit voltages of the thinner cells when a low surface-recombination velocity is assumed. Thus, a number of material combinations which previously could only be used in four-terminal configurations can now be considered for series-connected two-junction solar cells.

1406 Photovoltaic Power Systems

52933 (TKK-F–A615) **A fast parametrization procedure for solar cells.** Lund, P.D.; Pylkkaenen, T. Helsinki Univ. of Technology, Otaniemi (Finland). Dept. of Technical Physics. 1987. 9p. Order Number DE91707473. Source: NTIS (US Sales Only), PC A02/MF A01.

In this paper, a simple mathematical procedure is presented for the parametrization of the temperature dependent solar cell current-voltage characteristics by using standard measured data. The silicon cells studied here are described by five parameters. The method has been applied to several different photovoltaic modules the inaccuracy of fit being less than 1.0% in all studied cases. On a IBM XT PC compatible microcomputer, a parameter fit requires in average 50-100 seconds. The model is well applicable for engineering purposes.

1408 Ocean Energy Systems

52934 (NEDO-P–8917) **Research on electric power source situation for application of OTEC in island countries in Pacific Ocean.** New Energy Development Organization, Tokyo (Japan). Mar 1990. 67p. (In Japanese). Order Number DE91715393. Source: NTIS (US Sales Only), PC A04/MF A01.

OTEC (Ocean Thermal Energy Conversion) in island countries in the Pacific Ocean was investigated in needs and feasibility study. The OTEC converts thermal energy, due to difference in temperature between shallow/hot seawater (25 to 30 centigrade) and deep/cold seawater (4 to 7 centigrade), into electric energy. It comprises closed cycle to use low boiling point operating medium and open cycle to use seawater vapor as is by vacuum evaporation. It is possible in recycling and does not give any public nuisance nor destroy the global environment. Output power is stable and storage facilities are not necessary. For power generation only, it is hardly independent in economicality but, if designed for multi-purpose use in combination with agriculture, breeding, desalination, air cooling, etc., can contribute to regional development and activation. The feasible condition necessitates difference in temperature to be more than 20 centigrade and cold seawater intake to be short in pipe length. Economicality, safe operation and maintenance, and social condition being taken into consideration, Bali, Christmas, Vitileve, Pohnpei and other islands, totally eight points, were selected as applicable regions. 30 refs., 21 figs., 15 tabs.

52935 (SERI/TP–253-3594) **Carbon dioxide release from ocean thermal energy conversion (OTEC) cycles.** Green, H.J. (Solar Energy Research Inst., Golden, CO (USA)); Guenther, P.R. Solar Energy Research Inst., Golden, CO (USA). Sep 1990. 12p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC02-83CH10093. (CONF-8911151–3: ICOER '89: 1st international conference on ocean energy recovery, Honolulu, HI (USA), 28-30 Nov 1989). Order Number DE89009504. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This paper presents the results of recent measurements of CO_2 release from an open-cycle ocean thermal energy conversion (OTEC) experiment. Based on these data, the rate of short-term CO_2 release from future open-cycle OTEC plants is projected to be 15 to 25 times smaller than that from fossil-fueled electric power plants. OTEC system that incorporate subsurface mixed discharge are expected to result in no long-term release. OTEC plants can significantly reduce CO_2 emissions when substituted for fossil-fueled power generation. 12 refs., 4 figs., 3 tabs.

1410 Solar Collectors and Concentrators

52936 (CONF-9005183–, pp. 168-174) **Nonimaging optics: Collecting light at the thermodynamic limit.** Winston, R. (Univ. of Chicago, IL (USA)). Argonne National Lab., IL (USA). [1990]. DOE Contract FG02-87ER13726. From 8. symposium on energy engineering sciences: micro/macro studies of multiphase media; Argonne, IL (USA); 9-11 May 1990. In *Proceedings of the eighth symposium on energy engineering sciences: Micro/macro studies of multiphase media.* 254p. Order Number DE90014844. Source: NTIS, PC A12/MF A01.

High collection nonimaging optics allows concentration of light at the thermodynamic limit. Applications of this new technology are found in signal detection, solar energy concentration, illumination and laser pumping. 2 refs., 4 figs.

52937 (SAND–90-0903C) **Solar concentrator development in the United States.** Alpert, D.J. (Sandia National Labs., Albuquerque, NM (USA)); Mancini, T.R.; Houser, R.M.; Crossman, J.W.; Schissel, P.; Carasso, M.; Jorgensen, G.; Scheve, M. Sandia National Labs., Albuquerque, NM (USA). [1990]. 22p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC04-76DP00789 ;AC02-83CH10093. (CONF-9008139–2: 5. international symposium on solar high-temperature technologies, Davos (Switzerland), 27-31 Aug 1990). Order Number DE91001232. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Sandia National Laboratories leads the US Department of Energy's solar concentrator development program in a joint effort with the Solar Energy Research Institute. The goal of DOE's program is to develop, build and test solar concentrators that are low in cost, have high performance, and long lifetimes. Efforts are currently focused on three areas: low-cost heliostats, point-focus parabolic dishes, and durable reflective films. The status and future plans of DOE's program in each area are reviewed. 29 refs., 7 figs.

52938 **Salinity gradient solar ponds.** Hull, J.R. (Argonne National Lab., IL (USA)); Nielsen, J.; Golding, P. 288p. CRC Press Inc., Boca Raton, FL (USA) (1988).

Topics covered in this book include: Solar ponds-a world survey, Thermal performance, Dynamical processes and external influences, Solar pond practice, Problems, misconceptions, and errors:how ponds go wrong, Candidate salts and Biological, chemical, and electrochemical considerations.

1420 Heat Storage

52939 (TKK-F–A617) **A feasibility study of seasonal thermal storage in solar heating systems for southern climates.** Kenisarin, M.M.; Karabaev, M.K.; Lund, P.D. Helsinki Univ. of Technology, Otaniemi (Finland). Dept. of Technical Physics. 1987. 22p. Order Number DE91707475. Source: NTIS (US Sales Only), PC A03/MF A01.

Numerical computer simulations of solar district heating plants with seasonal thermal storage for Tashkent conditions is discussed. A water pit is considered as the storage medium. The effects of different collector absorber surface types and of water pit top thermal insulation are investigated. Optimum relationships between collector area and storage volume are presented. It is shown that in southern climates a solar fraction of 50-60% can be achieved at lowest solar component cost for a central solar heating plant with seasonal thermal storage. A short review of the various basic concepts for seasonal thermal storage is also presented.

52940 (TKK-F–A651) **Evaluation of aquifer storage CSHPSS systems.** Peltola, S. Helsinki Univ. of Technology, Otaniemi (Finland). Dept. of Technical Physics. 1989. 28p. Order Number DE91707478. Source: NTIS (US Sales Only), PC A03/MF A01.

This report relates to International Energy Agency (IEA) Solar Heating and Cooling Programme Task VII work. In the Task VII, several existing CSHPSS plants have been evaluated and thus a considerable amount of experience has been collected about CSHPSS technology among the participating countries. Based on this experience, three so called generic systems have been identified by the task participants. They are: water storage with high temperature collectors and without heat pump, duct storage with high/medium temperature collectors with or without heat pump and aquifer storage with low temperature collectors and with heat pump. All the systems have been analyzed by a working group using a common computational tool, MINSUN/1./. The goal of the study was to find out the most suitable system configurations in four different climates using the latest knowledge about the technology. In order to make the results comparable with each other, common assumptions and boundary conditions were used. This report describes the results of analyses of aquifer based CSHPSS systems. They have been calculated with MINSUN model but some additional analyses have been made with a special aquifer thermal analysis program THETA. The system setup and basic assumptions are briefly described in chapter 2. Additional information on the MINSUN itself can be found e.g. from /1./. The MINSUN simulations are described in chapter 3. and sensitivity analyses in chapter 4. Chapter 5. describes the comparison of MINSUN simulations with THETA.

15 GEOTHERMAL ENERGY

1501 Resources and Availability

52941 (AD-A–224275/8/XAB) **Coso Monitoring Program, October 1988 through September 1989. Summary report, 1 October 1988-30 September 1989.** Bjornstad, S.C.; Monahan, J.H.; Edwards, E.M. Naval Weapons Center, China Lake, CA (USA). Mar 1990. 116p. (NWC-TP–7056). Source: NTIS, PC A06/MF A01.

The Coso Monitoring Program is a continuing effort in support of the development of the Navy's geothermal resources within the Coso Known Geothermal Resource Area (KGRA).

1502 Geology and Hydrology of Geothermal Systems

52942 **Modeling of geothermal reservoirs: Fundamental processes, computer simulation and field applications.** Pruess, K. (Earth Sciences Div., Lawrence Berkeley Lab., Univ. of California, Berkeley, CA (US)). *Geothermics (International Journal of Geothermal Research and its Applications) (UK),* 19(1): 3-16 (1990).

This article critically evaluates the present state of the art of geothermal reservoir simulation. Methodological aspects of geothermal reservoir modeling are reviewed, with special emphasis on flow in fractured media. The authors then examine some applications of numerical simulation to studies of reservoir dynamics, well test design and analysis, and modeling of specific fields. Tangible impacts of reservoir simulation technology on geothermal energy development are pointed out. The authors conclude with considerations on possible future developments in the mathematical modeling of geothermal fields.

1503 Geothermal Exploration and Exploration Technology

52943 (NEDO-P–8909) **Research study on the improvement of the geothermal well drilling and completion work performance.** New Energy Development Organization, Tokyo (Japan). Mar 1990. 165p. (In Japanese). Order Number DE91715395. Source: NTIS (US Sales Only), PC A08/MF A01.

In order to improve geothermal well drilling efficiency, research study in FY 1989 being made in continuation of that in FY 1987 and 1988, highly-efficient advanced drilling system was studied through summarization of research study during the three years. In research study so far, six technologies, ie., aerated mud drilling method, low specific gravity (foam) cementing method, overhead-drive drilling method, high-speed turbo drill and shock-resisting PDC bit, low-speed and heat-resisting turbo drill, and heat-resisting MWD were elucidated in advantage and disadvantage. Then, the following four systems, were selected: (1) highly-efficient hybrid system of aerated mud drilling and foam cementing completion, (2) high accuracy directional drilling system, (3) highly-efficient and heat-resisting MWD system and (4) highly-efficient overhead-drive drilling system. Those four systems being comparatively studied, (3) and (2) were made to be of advanced technology development

type, while (1) and (4) were done to be of actual proof development type. They were also determined in development priority. 6 refs., 40 figs., 21 tabs.

1509 Geothermal Engineering

Refer also to citation(s) 52942

17 WIND ENERGY

1706 Wind Energy Engineering

52944 (SAND–90-1148C) **Customized airfoils and their impact on VAWT [Vertical-Axis Wind Turbine] cost of energy.** Berg, D.E. Sandia National Labs., Albuquerque, NM (USA). [1990]. 9p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC04-76DP00789. (CONF-9009107–1: Windpower '90, Washington, DC (USA), 25-28 Sep 1990). Order Number DE91000408. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Sandia National Laboratories has developed a family of airfoils specifically designed for use in the equatorial portion of a Vertical-Axis Wind Turbine (VAWT) blade. An airfoil of that family has been incorporated into the rotor blades of the DOE/Sandia 34-m diameter VAWT Test Bed. The airfoil and rotor design process is reviewed. Comparisons with data recently acquired from flow visualization tests and from the DOE/Sandia 34-m diameter VAWT Test Bed illustrate the success that was achieved in the design. The economic optimization model used in the design is described and used to evaluate the effect of modifications to the current Test Bed blade. 1 tab., 11 figs., 13 refs.

52945 (SAND–90-1149C) **Fatigue analysis of WECS [Wind Energy Conversion System] components using a rainflow counting algorithm.** Sutherland, H.J.; Schluter, L.L. Sandia National Labs., Albuquerque, NM (USA). [1990]. 8p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC04-76DP00789. (CONF-9009107–2: Windpower '90, Washington, DC (USA), 25-28 Sep 1990). Order Number DE91000774. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

A "rainflow counting algorithm" has been incorporated into the LIFE2 fatigue/fracture analysis code for wind turbines. The count algorithm, with its associated pre- and post-count algorithms, permits the code to incorporate time-series data into its analysis scheme. After a description of the algorithms used here, their use is illustrated by the examination of stress-time histories from the Sandia 34-m Test Bed vertical axis wind turbine. The results of the rainflow analysis are compared and contrasted to previously reported predictions for the service lifetime of the fatigue critical component for this turbine. 14 refs., 8 figs., 3 tabs.

52946 (SAND–90-2538C) **Fatigue reliability of wind turbine components.** Veers, P.S. Sandia National Labs., Albuquerque, NM (USA). [1990]. 8p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC04-76DP00789. (CONF-9009107–3: Windpower '90, Washington, DC (USA), 25-28 Sep 1990). Order Number DE91001262. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

Fatigue life estimates for wind turbine components can be extremely variable due to both inherently random and uncertain parameters. A structural reliability analysis is used to qualify the probability that the fatigue life will fall short of a selected target. Reliability analysis also produces measures of the relative importance of the various sources of uncertainty and the sensitivity of the reliability to each input parameter. The process of obtaining reliability estimates is briefly outlined. An example fatigue reliability calculation for a blade joint is formulated; reliability estimates, importance factors, and sensitivities are produced. Guidance in selecting distribution functions for the random variables used to model the random and uncertain parameters is also provided. 5 refs., 9 figs., 1 tab.

52947 (SERI/TP–257-3983) **Spanwise aerodynamic loads on a rotating wind turbine blade.** Butterfield, C.P.; Simms, D.; Musial, W.; Scott, G. SRI International, Menlo Park, CA (USA). Oct 1990. 6p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC02-83CH10093. (CONF-9009107–4: Windpower '90, Washington, DC (USA), 25-28 Sep 1990). Order Number DE91002101. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Wind turbine performance and load predictions depend on accurate airfoil performance data. Wind tunnel test data are typically used which accurately describe two-dimensional airfoil performance characteristics. Usually these data are only available for a range of angles of attack from 0 to 15 deg, which excludes the stall characteristics. Airfoils on stall-controlled wind turbines operate in deep stall in medium to high winds. Therefore it is very important to know how the airfoil will perform in these high load conditions. Butterfield et al. have shown that three-dimensional effects and rotation of the blade modify the two-dimensional performance of the airfoil. These effects are modified to different degrees throughout the blade span. The Solar Energy Research Institute (SERI) has conducted a series of tests to measure the spanwise variation of airfoil performance characteristics on a rotating wind turbine blade. Maximum lift coefficients were measured to be 200% greater than wind tunnel results at the 30% span. Stall characteristics were generally modified throughout the span. Lift characteristics were unmodified for low to medium angles of attack. This paper discusses these test results for four spanwise locations. 8 refs., 12 figs.

52948 (SERI/TR–257-3372) **Smoothing and scaling airfoil coordinates on a personal computer.** Tu, P.K.C.; Scott, G.N. Solar Energy Research Inst., Golden, CO (USA). Dec 1989. 79p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC02-83CH10093. Order Number DE89000878. Source: NTIS, PC A05/MF A01 - OSTI; GPO Dep.

A mainframe computer program written for smoothing and scaling successfully coordinates by Harry L. Morgan, Jr., of NASA Langley Research Center was successfully adapted for use on personal computers (IBM PC or compatible microcomputers). The program was modified with a new format for input/output files, keyboard selection of plotting and printing options, and the ability to preview plots on a PC monitor before pen plotting. The new source code was then recompiled on a PC and used mainly for the purpose of supporting in-house aerodynamic research work. It was made compatible with other in-house codes. This report lists the system specifications for PCs and describes briefly the NASA Langley program and its theories used for smoothing and scaling airfoil coordinates. A flow chart of the program and the input/output files are explained in detail. A step-by-step manual of executing the code on a PC and the results of sample runs are included. Also included is an evaluation section of airfoil performance characteristics by using a low Reynolds number airfoil design and analysis computer code created by Dr. Eppler to demonstrate the significance or any discrepancies as a result of the smoothing and scaling. 5 refs., 7 figs.

20 FOSSIL-FUELED POWER PLANTS

2001 Power Plants and Power Generation

Refer also to citation(s) 52622, 52627, 52641, 52695, 52696, 52697, 52698, 52699, 52700, 52701, 52705, 52714, 52715, 52923, 52959, 52961, 53134, 53165, 53175

52949 (DOE/ET/17019–T3) **Development of molten carbonate fuel cell power plant: Reference plant design description, requirements, and goals.** Parker, K.M. General Electric Co., Schenectady, NY (USA). Advanced Energy Programs Dept. Sep 1982. 161p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC02-80ET17019. Order Number DE84000211. Source: NTIS, PC A08/MF A01 - OSTI; GPO Dep.

This report presents the results of the Carbonate Fuel Cell reference power plant description. In addition, fuel cell module and stack requirements are defined and fuel cell goals updated based upon this reference plant description. 32 figs., 33 tabs.

52950 (DOE/FE–0201P) **Comprehensive report to Congress Clean Coal Technology Program: Combustion Engineering IGCC [Integrated Gasification Combined Cycle] Repowering**

Project. USDOE Assistant Secretary for Fossil Energy, Washington, DC (USA). Office of Clean Coal Technology. Oct 1990. 24p. Sponsored by U.S. DOE Fossil Energy. Order Number DE91001054. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This project will demonstrate Integrated Gasification Combined Cycle (IGCC) technology in a commercial application by the repowering of an existing City Water, Light and Power (CWL&P) Plant in Springfield, Illinois. The project duration will be 126 months, including a 63-month demonstration period. The estimated cost of the project is $270,700,000 of which $129,357,204 will be funded by DOE. The IGCC system will consist of CE's air-blown, entrained-flow, two-stage, pressurized coal gasifier; an advanced hot gas cleanup process; a combustion turbine modified to use low Btu coal gas; and all necessary coal handling equipment. An existing 25-MWe steam turbine and associated equipment will also be part of the IGCC system. The result of repowering will be an IGCC power plant with low environmental emissions and high net plant efficiency. The repowering will increase plant output by 40 MWe through addition of the combustion turbine, thus providing a total IGCC capacity of a nominal 65 MWe. 3 figs., 2 tabs.

52951 (EPRI-GS–6936) **Surge protection of generators: Final report.** Dick, E.P. (Rensselaer Polytechnic Inst., Troy, NY (USA)); Gupta, B.K.; Greenwood, A.; Cheung, R.W.; Dhirani, H.; Lishchyna, L. Electric Power Research Inst., Palo Alto, CA (USA); Ontario Hydro, Toronto, ON (Canada); Rensselaer Polytechnic Inst., Troy, NY (USA). ©Oct 1990. 430p. Sponsored by Electric Power Research Institute. Source: Research Reports Center, Box 50490, Palo Alto, CA 94303.

Generator windings may be stressed beyond their normal power frequency duty by a variety of disturbances. Steep-fronted surge sources include lightning, nearby faults, circuit breaker closing, reignitions and restrikes. Medium frequency oscillatory overvoltages include the transfer of lighting induced surges through transformers, line faults, fault clearing, multiple reignitions, arcing bus faults, series arcing on busses, and HV switching. Power frequency overvoltages include self excitation, harmonic line resonance, HV to LV faults in transformers, stuck breaker pole and bus faults and several kinds of ferroresonance. The overvoltages for each contingency were modeled in detail, typically using the ElectroMagnetic Transient Program, with the results also quantified in terms of simpler formulas. The probabilities controlling these contingencies were estimated. Stress distributions within windings were simulated for single-turn and multi-turn coil machines. This includes internal winding resonances in the 20-kHz range and amplification of a steep-fronted surge at the end of the first winding slot. The groundwall insulation breakdown strength was tested for more than 100 coils in five machines with varying service ages using dc, power frequency and impulses. These results were compared with specified withstands for generators. The vulnerability of metal oxide arresters to temporary overvoltages and the high ambient temperatures found in generating stations was studies. Historical methods for calculating overvoltages were critically reviewed. A utility survey uncovered weakness in the present design of surge protection. Results of extensive low voltage and full power field tests were used to develop improved models for simulations. 170 refs., 150 figs., 10 tabs.

52952 (EPRI-GS–6985) **Proceedings: 1989 EPRI heat-rate improvement conference.** Electric Power Research Inst., Palo Alto, CA (USA); Plant Performance, Knoxville, TN (USA). ©Sep 1990. 760p. Sponsored by Electric Power Research Institute. (CONF-8909143–; 1989 EPRI heat-rate improvement conference, Knoxville, TN (USA), 26-28 Sep 1989). Source: Research Reports Center, Box 50490, Palo Alto, CA 94303.

EPRI, in conjunction with ASME, conducted a three-day conference, September 26–28, 1989, in Knoxville, Tennessee. This conference, hosted by TVA, attracted more than 400 utility representative, manufactures, and architect/engineering firms for presentations of 50 papers on specific aspects of heat-rate improvement. Special discussions addressed retrofit and advanced design considerations, and individual working groups investigated recent developments in performance monitoring and instrumentation, computer applications, and coal quality measurement. Presentations encompassed total plant analysis, as well as more detailed system and component analysis. Overall, performance modeling and system monitoring yield improved heat rate and unit availability. The conference covered a wide range of equipment improvements, including retractable turbine packing rings, boiler heat distribution measurement techniques, ash analysis techniques, turbine monitoring software, and methods of minimizing acid condensation as well as fouling of regenerative air preheaters. Individual projects are processed separately for the databases.

52953 (EPRI-GS–6987) **CAES [conventional compressed-air energy storage] plant with steam generation: Preliminary design and cost analysis: Final report.** Nakhamkin, M. (Energy Storage and Power Consultants, Mountainside, NJ (USA)); Swensen, E.C.; Abitante, P.A. Electric Power Research Inst., Palo Alto, CA (USA); Energy Storage and Power Consultants, Mountainside, NJ (USA). ©Oct 1990. 173p. Sponsored by Electric Power Research Institute. Source: Research Reports Center, Box 50490, Palo Alto, CA 94303.

A study was performed to evaluate the performance and cost characteristics of two alternative CAES-plant concepts which utilize the low-pressure expander's exhaust-gas heat for the generation of steam in a heat recovery steam generator (HRSG). Both concepts result in increased net-power generation relative to a conventional CAES plant with a recuperator. The HRSG-generated steam produces additional power in either a separate steam-turbine bottoming cycle (CAESCC) or by direct injection into and expansion through the CAES-turboexpander train (CAESSI). The HRSG, which is a proven component of combined-cycle and cogeneration plants, replaces the recuperator of a conventional CAES plant, which has demonstrated the potential for engineering and operating related problems and higher costs than were originally estimated. To enhance the credibility of the results, the analyses performed were based on the performance, operational and cost data of the 110-MW CAES plant currently under construction for the Alabama Electric Cooperative (AEC). The results indicate that CAESCC- and CAESSI-plant concepts are attractive alternatives to the conventional CAES plant with recuperator, providing greater power generation, up to 44-MW relative to the AEC CAES plant, with competitive operating and capital costs. 5 refs., 43 figs., 26 tabs.

52954 (IEACR–28) **World coal-fired power stations.** Mannini, A.; Daniel, M.; Kirchner, A.; Soud, H. IEA Coal Research, London (UK). ©Sep 1990. 285p. Sponsored by International Energy Agency. Source: IEA Coal Research, Gemini House, 10-18 Putney Hill, London, SW15 6AA, United Kingdom.

This report describes coal-fired electric power generating capacity worldwide and outlines the structure of the electricity industry in major coal consuming countries. An introductory chapter provides an overview of coal-fired power station capacity and distribution and discusses the major issues affecting the growth of steam coal use for power generation. For each of 51 countries a list is provided of existing coal-fired plants as well as those under construction and planned. Details of coal-fired capacity, unit size, fuel type, emission control equipment and coal specifications by utilities are given where available. The tables are supplemented with accounts of each country's electricity industry and maps showing the location and size of major (>300 MW) coal-fired stations. The directory is indexed by plant name. 57 refs.

52955 (PNL-SA–17712) **Thermal energy storage for an integrated coal gasification combined-cycle power plant.** Drost, M.K.; Antoniak, Z.I.; Brown, D.R. Pacific Northwest Lab., Richland, WA (USA). Mar 1990. 7p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC06-76RL01830. (CONF-900801–35: 25. intersociety energy conversion engineering conference, Reno, NV (USA), 12-17 Aug 1990). Order Number DE91000974. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

This study investigates the use of molten nitrate salt thermal energy storage in an integrated gasification combined-cycle power plant allowing the facility to economically provide peak- and intermediate-load electric power. The results of the study show that an integrated gasification combined-cycle power plant with thermal energy storage can reduce the cost of coal-fired peak- or intermediate-load electric power by between 5% and 20% depending on the plants operating schedule. The use of direct-contact salt

heating can further improve the economic attractiveness of the concept. 11 refs., 1 fig., 4 tabs.

2002 Waste Management

Refer also to citation(s) 52657, 52659, 52667, 52705, 52715, 52949, 52950, 52954, 53166

52956 (CONF-850522–4) **Low turbulence/high efficiency cyclone separators: Facility qualification results.** Razgaitis, R. (Battelle Columbus Div., OH (USA)); Paul, D.D.; Bioarski, A.A.; Jordan, H.; Brodkey, R.S.; Munson-McGee, M. Battelle Columbus Div., OH (USA). [1985]. 16p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC21-83MC20108. From 5. annual contractors' review meeting on contaminant control in hot coal derived gas streams; Morgantown, WV (USA); 7-9 May 1985. Order Number DE91001507. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The objective of this work is to experimentally investigate the near-wall turbulent flow-fields characteristic of cyclone separators in order to determine the influence of wall-originating turbulence on the separation of fine particles. In particular, seven turbulence suppression concepts will be evaluated with reference to a well-established baseline condition. Concepts which appear attractive will be studied and characterized in more detail. The work accomplished to date is principally the design, construction, and qualification of two of the facilities that will be used to study the various concepts of turbulence suppression. The qualification of the primary facility, the Cyclonic Wind Tunnel (CWT), has required the development and adaptation of laser Doppler velocimetry (LDV) to perform simultaneous two-dimensional turbulence measurements in a highly swirling flow. A companion facility to the CWT is the Curvilinear Boundary Layer (CBL) apparatus. The purpose of the CBL is to provide a thick, visually-observable near-wall flow region under dynamically similar conditions to the CWT to that a physical understanding of the turbulence suppression process can be obtained. 9 refs., 15 figs.

52957 (DOE/PC/88865–T3) **Flow studies and particulate collection measurements: "A laminar flow, reduced entrainment electrostatic precipitator": Final report.** Greiner, G.P.; Furlong, D.A.; Bahner, M.A. ETS, Inc., Roanoke, VA (USA). Apr 1990. 50p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC22-88PC88865. Contract 88-823-C. Order Number DE90016800. Source: NTIS, PC A10/MF A01 - OSTI; GPO Dep.

This report describes testing of a Reduced Entrainment electrostatic Precipitator (REP) that has a portion of the main precipitator flow drawn through a porous (fabric) collecting surface. Tests investigated effects of flow through the collecting surface (side flow) on precipitator turbulence and particulate removal efficiency. Testing focused on these effects as being significant to the collection of fine (less than 10 microns) particulate. 17 refs., 41 figs., 10 tabs.

52958 (DOE/PC/88867–T8) **Electrostatic precipitation of condensed acid mist: Sixth quarterly technical progress report, April 1–June 30, 1990.** Southern Research Inst., Birmingham, AL (USA). [1990]. 8p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC22-88PC88867. (SRI-ENV–90-683-6657-XXV). Order Number DE91000697. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

This project addresses the acid mist that is formed by condensation of sulfuric acid vapor in flue gas from coal-fired utility boilers. An acid mist can be formed whenever the flue gas temperature approaches the prevailing acid dew point. This commonly occurs when the gas is subjected to rapid adiabatic cooling in a wet scrubber system for flue gas desulfurization. Acid mists can also sometimes result from unexpected temperature excursions caused by air inleakage, load cycling, and start-up operations. A wet electrostatic precipitator (WESP) is the best control option for acid mist. The mist would blind a fabric filter and attach glass fiber fabrics. A wet ESP is required because the acid would quickly corrode the plates in a conventional dry ESP. The wet ESP also offers the advantages of no rapping reentrainment and no sensitivity to fly ash resistivity. Therefore, this program has been structured around the use of a compact, wet ESP to control acid mist emissions. Progress to date is discussed. 7 refs., 1 fig.

52959 (ORNL/FTR–3752) **[Collaborative coal project between the USA and India]: Foreign trip report, August 30, 1990–September 19, 1990.** Krishnan, R.P. Oak Ridge National Lab., TN (USA). 5 Oct 1990. 27p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC05-84OR21400. Order Number DE91001530. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Under the Phase II, Alternative Energy Resources Development (AERD) project of the United States Agency for International Development (USAID) and the Government of India (GOI), five collaborative coal projects have been initiated in the areas of: (1) NO_x/SO_x control from coal-fired power plants, (2) slagging combustor development for high-ash Indian coals, (3) characterization of Indian coals for combustion and gasification. (4) diagnostic studies for prediction of power plant life expectancy, and (5) environmental and natural resource analysis of coal cycle. The Pittsburgh Energy Technology Center (PETC) has the implementation responsibility for these projects. The Indian collaborative institutions identified for these projects are the Bharat Heavy Electricals Ltd. (BHEL), Trichy, (projects 1–4), and the Tata Energy Research Institute (TERI) for project 5. The Oak Ridge National Laboratory (ORNL) is providing cross-cut technical coordination and support for these five projects.

2004 Health and Safety

Refer also to citation(s) 53844

2005 Environmental Aspects

Refer also to citation(s) 52923, 53104, 53105, 53637

52960 (DOE/FE/62072–T1) **Haze in the Grand Canyon: An evaluation of the Winter Haze Intensive Tracer Experiment.** National Research Council, Washington, DC (USA). Committee on Haze in National Parks and Wilderness Areas. Oct 1990. 102p. Sponsored by U.S. DOE Fossil Energy; U.S. Department of the Interior; Environmental Protection Agency. DOE Contract FG01-90FE62072. 14-01-0001-89-C-39. Order Number DE91000822. Source: NTIS, PC A06/MF A01; OSTI; National Academy Press, 2101 Constitution Ave., NW, Washington, DC 20418; GPO Dep.

The Grand Canyon is one of the most spectacular natural sights on earth. Approximately 4 million visitors travel to Grand Canyon National Park (GCNP) each year to enjoy its majestic geological formations and intensely colored views. However, visibility in GCNP can be impaired by small increases in concentrations of fine suspended particles that scatter and absorb light; the resulting visibility degradation is perceived as haze. Sulfate particles are a major factor in visibility impairment at Grand Canyon in summer and winter. Many wintertime hazes at GCNP are believed to result from the accumulation of emissions from local sources during conditions of air stagnation, which occur more frequently in winter than in summer. In January and February 1987, the National Park Service (NPS) carried out a large-scale experiment known as the Winter Haze Intensive Tracer Experiment (WHITEX) to investigate the causes of wintertime haze in the region of GCNP and Canyonlands National Park. The overall objective of WHITEX was to assess the feasibility of attributing visibility impairment in specific geographic regions to emissions from a single point source. The experiment called for the injection of a tracer, deuterated methane (CD_4), into one of the stacks of the Navajo Generating Station (NGS), a major coal-fired power plant located 25 km from the GCNP boundary and 110 km northeast of Grand Canyon Village. A network of field stations was established in the vicinity – mostly to the northeast of GCNP and NGS – to measure CD_4 concentrations, atmospheric aerosol and optical properties, and other chemical and physical attributes. 19 refs., 3 figs.

2006 Economic, Industrial, and Business Aspects

Refer also to citation(s) 52949

21 NUCLEAR POWER PLANTS

Refer also to citation(s) 54394, 54415

52961 (EPRI-NP–6973) **Infrared thermography guide: Final report.** Lucier, R.D. (American Risk Management Corp., Cleveland, OH (USA)); Kaplan, H.L. Electric Power Research Inst., Palo Alto, CA (USA); American Risk Management Corp., Cleveland, OH (USA); Honeyhill Technical, Norwalk, CT (USA). ©Sep 1990. 140p. Sponsored by Electric Power Research Institute. Source: Research Reports Center, Box 50490, Palo Alto, CA 94303.

Costly equipment outages can be reduced by implementing a comprehensive predictive maintenance program. Infrared thermography (IR), a fundamental component of an effective predictive maintenance program, uses nonintrusive techniques to monitor the operating condition of equipment and components. This report provides information to assist utilities in their efforts to implement an effective IR program. 16 refs., 42 figs., 7 tabs.

2101 Power Reactors, Nonbreeding, Light-Water Moderated, Boiling Water Cooled

Refer also to citation(s) 52779, 52989, 53056, 53057, 53060, 53071, 53077, 53078, 53079, 53082, 53225, 53226, 53428

52962 (CONF-9010224–1) **Application of Galerkin's method for calculating boiling water reactor limit-cycle amplitude using the LAPUR feedback-transfer function and the point-kinetics equations.** Damiano, B. (Oak Ridge National Lab., TN (USA)); March-Leuba, J.A.; Euler, J.A. Oak Ridge National Lab., TN (USA). [1990]. 13p. Sponsored by U.S. DOE Nuclear Energy; Nuclear Regulatory Commission. DOE Contract AC05-84OR21400. From International workshop on BWR stability; Upton, NY (USA); 18 Oct 1990. Order Number DE91001517. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

This paper describes a technique for calculating boiling water reactor (BWR) behavior during steady-state limit-cycle oscillations. An approximate solution is obtained from the application of Galerkin's method to a BWR dynamic model consisting of the point-kinetics equations and the LAPUR-calculated power-to-reactivity feedback-transfer function. The approximate-solution technique is described, and comparisons of approximate solutions with numerical results and measured data are given. 7 refs., 5 figs.

52963 (EUR–12400) **Analysis of data from the Pericles and reflex experiments using the Codes Trac-PF1/MOD1 and QFLOOD.** Thomas, R.M. (Central Electricity Research Labs., Leatherhead, (UK)). Commission of the European Communities, Luxembourg (Luxembourg). Sep 1989. 217p. Contract No. 3147-87-05 ELISPGB. Source: NTIS (US Sales Only), PC A10/MF A01.

The computer programs TRAC-FP1/MOD1 and QFLOOD have been used to analyse data obtained from two reflood rigs: PERICLES, a 7 - 51 bundle arranged to investigate the chimney effect, and REFLEX, a single heated tube. TRAC produced poor predictions for PERICLES, the calculated temperature history curves at the 2.03 m elevation differing markedly from experiment. TRAC predictions for the REFLEX base case agreed quite well with experiment, but for a second REFLEX test, at higher inlet water flowrate, TRAC greatly overpredicted the quench front speed. QFLOOD also performed badly against PERICLES, quench time being overpredicted by more than 50%. A number of sensitivity studies were carried out in order to establish the source of the error in the modelling. Several possible explanations were investigated, but definite conclusions could not be drawn. QFLOOD predictions for REFLEX were generally satisfactory.

52964 (EUR–12403) **Assessment of RELAP5/MOD2 and RELAP5/MOD1-EUR codes on the basis of LOBI-MOD2 test results.** D'Auria, F. (Pisa Univ. (IT). Dipt. di Costruzioni Meccaniche e Nucleari); Mazzini, M.; Oriolo, F.; Galassi, G.M. Commission of the European Communities, Luxembourg (Luxembourg). Oct 1989. 100p. Contract No. 2992-86-07 ELISPI. Source: NTIS (US Sales Only), PC A05/MF A01.

The present report deals with an overview of the application of RELAP5/MOD2 and RELAP5/MOD1-EUR codes to tests performed in the LOBI/MOD2 facility. The work has been carried out in the frame of a contract between Dipartimento di Costruzioni Meccaniche e Nucleari (DCMN) of Pisa University and CEC. The Universities of Roma, Pisa, Bologna and Palermo and the Polytechnic of Torino performed the post-test analysis of the LOBI experiment under the supervision of DCMN. In the report the main outcomes from the analysis of the LOBI experiments are given with the attempt to identify deficiencies in the modelling capabilities of the used codes.

52965 (EUR–12404) **The application of Cathare 1 V1.3 to LOBI small break Loca experiments and a comparison with RELAP5/MOD2.** D'Auria, F. (Pisa Univ. (IT). Dipt. Costruzioni Meccaniche e Nucleari); Galassi, G.M. Commission of the European Communities, Luxembourg (Luxembourg). Sep 1989. 54p. Contract No. 2993-86-07 ELISPI. Source: NTIS (US Sales Only), PC A04/MF A01.

The paper presents an overview of the application of CATHARE V1.3 to LOBI Small Break LOCA tests, performed at Dipartimento di Costruzioni Meccaniche e Nucleari of Pisa University. In particular, the development of a new nodalization of LOBI facility is discussed along with the analysis of tests A2-81 (1% CL break). A1-83 (10% CL break) and A1-84 (10% HL break). In the second part of the paper, uncertainties are outlined which are typical of the analysis of experiments in integral test facilities. Finally, on the basis of the application of RELAP5/MOD2 to the analysis of test A2-81, a judgement is given about the behaviour of the two codes emphasizing the related advantages and disadvantages.

52966 (EUR–12405) **Assessment of the system code DRUFAN/ATHLET using results of LOBI tests.** Burwell, J.M. (Gesellschaft fuer Reaktorsicherheit m.b.H. (GRS) Garching (DE)); Kirmse, R.E.; Kyncl, M.; Malhotra, P.K. Commission of the European Communities, Luxembourg (Luxembourg). Sep 1989. 376p. Contract No. 3015-86-07 ELISPD. Source: NTIS (US Sales Only), PC A17/MF A01.

Four post-test analyses have been performed by GRS within the Shared Cost Action Programme (SCAP) sponsored by the Commission of the European Communities (contract 3015-86-07 EL ISP D) and by the Bundesminister fuer Forschung und Technologie of the Federal Republic of Germany (Research project RS 739). The four tests were mutually selected by the contractors (CEA, GRS, IKE, Univ. Pisa) of activity No. 3 and by the project organizer. Some of the tests were selected to be analyzed by more than one participant in order to allow comparison between analytical results obtained with different codes or obtained by different code-users. DRUFAN/ATHLET verification analyses were performed by IKE too. The four tests selected for the GRS activity are: - A2-77A (Natural Circulation Test), Analysis with ATHLET - A1-76 (Steam Generator Performance Test), Analysis with DRUFAN - BL-01 (Intermediate Leak), Analysis with ATHLET - A2-81 (Small Leak), Analysis with ATHLET. This final report contains the results of the four post test analysis including the comparison between measured and calculated quantities and the description of the applied codes, the selected model of the LOBI facility and the conclusions drawn for the improvement of the codes models.

52967 (EUR–12406) **Hydraulic behaviour of a partially uncovered core.** Fischer, K. (Battelle - Institut e V. Frankfurt am Main (DE)); Hafner, W. Commission of the European Communities, Luxembourg (Luxembourg). Oct 1989. 85p. Contract No. 3001-86-07 ELISPD. Source: NTIS (US Sales Only), PC A05/MF A01.

A critical review of experimental data and theoretical models relevant to the thermohydraulic processes in a partially uncovered core has been performed. Presently available optimized thermohydraulic codes should be able to predict swell level elevations within an error band of $\pm$ 0.5 m. Rod temperature rising velocities could be predicted within an error bandwidth of $\pm$ 10%, provided the correct rod heat capacity is given. A general statement about the accuracy of predicted rod temperatures is not possible because the errors increase with simulation time. Highest errors are expected for long transients with low heating rates and low steam velocities. As a result, three areas for additional research are suggested: - a high-pressure test at 120 bar to complete the void correlation data base, - a low steam flow - low power experiment to improve heat transfer correlations, - a numerical investigation of three-dimensional effects in the reactor core with unequally heated rod bundles. For the present state of 1-dimensional experiments and models, suggestions for a satisfactory modeling have been derived.

The suggested further work could improve the modelling capabilities and the code reliability for some limiting cases like high pressure boil-off, low-power long-term steam cooling, and unequal heating of neighbouring bundles considerably.

52968 (EUR–12407) **Analysis of experiments performed at University of Hannover with Relap5/Mod2 and Cathare codes on fluid dynamic effects in the fuel element top nozzle area during refilling and reflooding.** Ambrosini, W. (Pisa Univ. (IT). Dipt. di Costruzioni Meccaniche e Nucleari); D'Auria, F.; Di Marco, P.; Fantappie, G.; Giot, G.; Emmerechts, D.; Seynhaeve, J.M.; Zhang, J. Commission of the European Communities, Luxembourg (Luxembourg). Nov 1989. 144p. Contract No. 3145-87-07 ELISPB. Source: NTIS (US Sales Only), PC A07/MF A01.

The experimental data of flooding and CCFL in the fuel element top nozzle area collected at the University of Hannover have been analyzed with RELAP5/MOD2 and CATHARE V.1.3 codes. Preliminary sensitivity calculations have been performed to evaluate the influence of various parameters and code options on the results. However, an a priori rational assessment procedure has been performed for those parameters non specific in experimental data (e.g. energy loss coefficients in flow restrictions). This procedure is based on single phase flow pressure drops and no further tuning has been performed to fit experimental data. The reported experimental data and some others demonstrate the complex relation-ship among the involved physical quantities (film thickness, pressure drop etc.) even in a simple geometrical condition with well defined boundary conditions. In the application of the two advanced codes to the selected CCFL experiments it appears that sophisticated models do not simulate satisfactorily the measured phenomena mainly when situations similar to nuclear reactors are dealt with (rod bundles). This result should be evaluated considering that: - dimensional phenomena occurring in flooding experiments are not well reproducible with one dimensional models implemented in the two codes; - a rational and reproducible procedure has been used to fix some boundary conditions (K-tuning); there is the evidence that more tuning can be used to get results closer to the experimental ones in each specific situation; - the uncertainty bands in measured experimental results are not (entirely) specified. The work performed demonstrated that further applications to CCFL experiments of present codes appear to be unuseful. New models should be tested and implemented before any attempt to reproduce CCFL in experimental facilities by system codes.

52969 (EUR–12621) **Nondestructive detection of microstructural fatigue damage.** Willems, H. (Universitaet des Saarlandes, Saarbruecken, (DE)); Persch, H. Commission of the European Communities, Luxembourg (Luxembourg). Feb 1990. 49p. Contract No. 3012-86-07 ELISPD. Source: NTIS (US Sales Only), PC A03/MF A01.

Ultrasonic as well as magnetic investigations have been performed on a pressure vessel steel (A533, B class 1) in order to study the influence of fatigue loading on both elastic and magnetic material properties. Using laboratory specimens under two different loading conditions (tension-tension loading, tension-compression loading), material characteristics like ultrasonic velocity, ultrasonic absorption, coercivity, incremental permeability were measured and evaluated as a function of consumed lifetime. Only in case of macroscopic plastic deformation, significant changes of the measuring quantities were observed. Otherwise the effects are so small that the nondestructive detection of microstructural changes due to fatigue loading seems not to be feasible under practical conditions (for example at pressure vessels) with the techniques used. Besides a zero measurement, additional measurements on a 1:5 model vessel at JRC Ispra could not be carried out, because the planned fatigue tests were not performed by JRC Ispra during the research period.

52970 (KURRI-TR–328) **Proceedings of the technical committee on high conversion and high burnup reactors.** Shiroya, Seiji; Kanda, Keiji; Sekiya, Tamotsu (eds.). Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst. Feb 1990. 77p. (In Japanese). (CONF-8812148–: Technical committee on high conversion and high burnup reactors, Kumatori (Japan), 21-22 Dec 1988). Order Number DE91712930. Source: NTIS (US Sales Only), PC A05/MF A01.

The present issue is the proceedings of 'the Technical Committee on High Conversion and High Burnup Reactors' held at Kyoto University Research Reactor Institute (KURRI) on December 12 and 22, 1988. In this committee, members so much concerned with this theme were asked to report their recent accomplishment and activities. By such a program, the committee was intended to make a survey of future direction of research in this type of reactor. (J.P.N.).

52971 (NUREG/CR–5314-Vol.3) **Life assessment procedures for major LWR [light water reactor] components: Cast stainless steel components: Volume 3.** Jaske, C.E. (EG and G Idaho, Inc., Idaho Falls, ID (USA)); Shah, V.N. Nuclear Regulatory Commission, Washington, DC (USA). Div. of Engineering; EG and G Idaho, Inc., Idaho Falls, ID (USA). Oct 1990. 49p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC07-76ID01570. (EGG–2562-Vol.3). Source: NTIS, PC A04/MF A01 - GPO; OSTI; INIS.

This report presents a procedure for estimating the current condition and residual life of safety-related cast stainless steel components in light water reactors (LWRs). The procedure accounts for loss of fracture toughness caused by thermal embrittlement and includes the following: a review of design and fabrication records, inservice inspection records, and operating history; a fracture mechanics evaluation to determine the required toughness at end-of-life using worst-loads and worst-flaw indications; current and future toughness estimates; and criteria regarding continued service, repair, or replacement of the component being evaluated. The report discusses the available Charpy V-notch impact energy, fracture toughness, tensile strength, fatigue resistance, and fatigue-crack growth data, and presents two methods for assessing the degree of thermal embrittlement: metallurgical evaluation and analytical modeling of inservice degradation. 74 refs., 21 figs., 5 tabs.

52972 (NUREG/CR–5605) **LAPUR benchmark against in-phase and out-of-phase stability tests.** March-Leuba, J. (Oak Ridge National Lab., TN (USA)). Nuclear Regulatory Commission, Washington, DC (USA). Div. of Systems Technology; Oak Ridge National Lab., TN (USA). Oct 1990. 27p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC05-84OR21400. (ORNL/TM–11621). Source: NTIS, PC A03/MF A01 - GPO; OSTI; INIS.

This paper documents a benchmark of the LAPUR code vs experimental stability data collected during startup testing of the Oskarshamn-3 reactor. The data consist of decay ratios and natural frequencies of oscillation measured under several reactor operating conditions. Satisfactory agreement was found between the measured decay and those calculated by LAPUR for both the in-phase and out-of-phase instability modes. The largest error (0.11) in the calculated decay ratio corresponded to test point 3, which corresponds to a very stable condition for which experimental decay ratio measurements are difficult. 4 refs., 8 tabs.

2102 Power Reactors, Nonbreeding, Light-Water Moderated, Nonboiling Water Cooled

Refer also to citation(s) 52963, 52964, 52965, 52966, 52967, 52968, 52969, 52970, 52971, 53038, 53042, 53053, 53054, 53055, 53056, 53057, 53059, 53060, 53071, 53074, 53075, 53076, 53079, 53086, 53087, 53089, 53225, 53226, 53297, 53428, 54173

52973 (AEEW-M–2555) **Analysis of the UPTF Separate Effects Test 11 (steam-water counter-current flow in the broken loop hot leg) using RELAP5/MOD2.** Dillistone, M.J. UKAEA Atomic Energy Establishment, Winfrith (UK). Safety and Engineering Science Div. Aug 1989. 24p. Order Number DE91606012. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

RELAP5/MOD2 predictions of countercurrent flow limitation in the UPTF hot leg separate effects Test (test 11) are compared with the experimental data. The code underestimates, by a factor of more than three, the gas flow necessary to prevent liquid runback from the steam generator, and this is shown to be due to an oversimplified flow-regime map which does not allow the possibility of stratified flow in the hot leg riser. The predicted countercurrent flow is also shown to depend, wrongly, on the depth of liquid in the

steam generator plenum. The same test is also modelled using a version of the code in which stratified flow in the riser is made possible. The gas flow needed to prevent liquid runback is then predicted quite well, but at all lower gas flows the code predicts that the flow is completely unrestricted - i.e. liquid flows between full flow and zero flow are not predicted. This is shown to happen because the code cannot calculate correctly the liquid level in the hot leg, mainly because of a numerical effect of upwind donoring in the momentum flux terms of the code's basic equations. It is also shown that the code cannot model the considerable effect of the ECCS injection pipe (which runs inside the hot leg) on the liquid level. (author).

52974 (AEEW-R-2426) **Experimental modelling of core debris dispersion from the vault under a PWR pressure vessel. Pt. 3: Results of varying the size scaling factor of the model used.** Macbeth, R.V.; Rose, P.W.; Mogford, D.J. UKAEA Atomic Energy Establishment, Winfrith (UK). Safety and Engineering Science Div. Sep 1989. 24p. Order Number DE91606013. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

This report principally addresses the question of whether experimental results obtained using a scaled down model of a PWR vault are affected by the size scale used. A wide range of equivalent tube geometries representing the main features of a PWR vault have been tested, using water and a liquid metal to simulate molten core debris, and high pressure air to simulate steam escaping from a hole in the pressure vessel. The experiments confirm that the dispersion phenomena occurring are not affected by the size scale of the model. This information has been used to simplify the general modelling equation, enabling a correlation of all previous data obtained from an exact 1/25 scale model (with a particular location of hole and with no internal structures) to be produced. Application of the correlation to a hypothetical severe accident in a full size reactor is discussed. (author).

52975 (CDTN-424/80) **TH-utilization in pressurized water reactors.** Centro de Desenvolvimento da Tecnologia Nuclear (CDTN), Belo Horizonte, MG (Brazil). Mar 1980. 83p. (HBK-IB-2/80). Order Number DE91606016. Source: NTIS (US Sales Only), PC A05/MF A01; OSTI; INIS.

This report is concerned to fabrication of $(Th,U)O_2$ - pellets for use in PWR reactors. (A.C.A.S.).

52976 (CDTN-ASPC.CN-001/89, pp. 14-20) **Progress report about thorium utilization in pressurized water reactors.** Pinheiro, R.B. Centro de Desenvolvimento da Tecnologia Nuclear (CDTN), Belo Horizonte, MG (Brazil). 1989. (In Portuguese). In *Semi-annual report of Nuclear Technology and Development Center (CDTN) - July to December 1988.* 353p. Order Number DE91606188. Source: NTIS (US Sales Only), PC A16/MF A01; OSTI; INIS.

The original objectives of the program running since mid 1979 are: to analyze and prove thorium utilization in pressurized water reactors; to design PWR fuel elements and core for the Th-fuel cycle; to manufacture, test and quality Th/U and Th/Pu fuel elements under operating conditions; to study the spent fuel treatment and to close the thorium fuel cycle by reprocessing spent Th- containing PWR fuel assemblies. The transfer of R and D methodology for the PWR fuel cycle presented the other main objective of this program. (E.G.).

52977 (CDTN-ASPC.CN-001/89, pp. 207-245) **Annual report of the thermal hydraulic and reactor safety program of the CDTN - 1988.** Pinheiro, R.B. Centro de Desenvolvimento da Tecnologia Nuclear (CDTN), Belo Horizonte, MG (Brazil). 1989. (In Portuguese). In *Semi-annual report of Nuclear Technology and Development Center (CDTN) - July to December 1988.* 353p. Order Number DE91606188. Source: NTIS (US Sales Only), PC A16/MF A01; OSTI; INIS.

The main activities developed in the program during the year of 1988 are described. (E.G.).

52978 (CEA-CONF-10048) **Early detection of deteriorations affecting neutron detectors methods applied in french PWR plants.** Bacconnet, E. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. d'Electronique et d'Instrumentation Nucleaire); Burel, J.P.; Meuwisse, C. CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. d'Electronique et d'Instrumentation Nucleaire. 1989. 12p. (CONF-8906196-: IAEA IWG-NPPCI specialists' meeting on early failure detection and diagnosis in nuclear power plants' systems and operational experience, Dresden (German Democratic Republic), 20-22 Jun 1989). Order Number DE91716286. Source: NTIS (US Sales Only), PC A03/MF A01.

The detection of a change in the behaviour of a nuclear instrumentation channel allows the rate of deterioration of the detector, the transmission line and the associated electronic part to be assessed. It authorizes preventive replacement of the faulty component. Two methods have been developed to improve the availability of neutronic measurement channels of French PWR units: 1 - The method referred to as saturation and discrimination curves which is used to check the state of ex-core neutron detectors, and, 2 - The reflectometry method which is particularly suitable for monitoring connection cables and connectors.

52979 (CONF-9010196-2-Vugraphs) **Potential effect of fracture technology on IPTS [Integrated Pressurized Thermal Shock] analysis (Fracture toughness: K_{Ia} and K_{Ic} and warm prestressing).** Dickson, T.L. Oak Ridge National Lab., TN (USA). [1990]. 24p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC05-84OR21400. From U.S.-Japan specialized topic workshop (STW) on pressurized thermal shock; Rockville, MD (USA); 26-28 Oct 1990. Order Number DE91000396. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

A major nuclear plant life extension issue to be confronted in the 1990's is pressure vessel integrity for the pressurized thermal shock (PTS) loading condition. Governing criteria associated with PTS are included in "The PTS Rule" (10 CFR 50.61) and Regulatory Guide 1.154: Format and Content of Plant-Specific Pressurized Thermal Shock Safety Analysis Reports for Pressurized Water Reactors. The results of the Integrated Pressurized Water Reactors. The results of the Integrated Pressurized Thermal Shock (IPTS) Program, along with risk assessments and fracture analyses performed by the NRC and reactor system vendors, contributed to the derivation of the PTS Rule. Over the last several years, the Heavy Section Steel Technology (HSST) Program at the Oak Ridge National Laboratory (ORNL) has performed a series of large-scale fracture-mechanics experiments. The Thermal Shock Experiments (TSE), Pressurized Thermal Shock Experiments (PTSE), and Wide Plate Experiments (WPE) produced K_{IC} and K_{Ia} data that suggest increased mean K_{IC} and K_{Ia} curves relative to the ones used in the IPTS study. Also, the PTSE and WPE have demonstrated that prototypical nuclear reactor pressure vessel steels are capable of arresting a propagating crack at K_I values considerably above 220 MPa$\sqrt{m}$, the implicit limit of the ASME Code and the limit used in the IPTS studies. This document provides a discussion of the results of these experiments.

52980 (EPRI-NP-6618) **Electropolishing qualification program for PWR steam generator divider plates: Final report.** Spalaris, C.N. (Quadrex Corp., Campbell, CA (USA)). Electric Power Research Inst., Palo Alto, CA (USA); Quadrex Corp., Campbell, CA (USA). ©Sep 1990. 70p. Sponsored by Electric Power Research Institute. Source: Research Reports Center, Box 50490, Palo Alto, CA 94303.

A program was conducted to establish electropolishing parameters for Inconel 600 plate and Inco 182 weld metal. Test parameters were chosen so as to define margins in the principal process variables, as a prerequisite for applying electropolishing to reactor components. The test program and evaluation of the results obtained are included in this report. 12 refs., 35 figs., 5 tabs.

52981 (EUR-12222) **Human factors reliability benchmark exercise: Synthesis report.** Poucet, A. (ed.). Commission of the European Communities, Luxembourg (Luxembourg). Aug 1989. 127p. Source: NTIS (US Sales Only), PC A07/MF A01.

The Joint Research Centre of the European Commission has organised a Human Factors Reliability Benchmark Exercise (HF-RBE) with the aim of assessing the state of the art in human reliability modelling and assessment. Fifteen teams from eleven countries, representing industry, utilities, licensing organisations and research institutes, participated in the HF-RBE. The HF-RBE

was organised around two study cases: (1) analysis of routine functional Test and Maintenance (TPM) procedures: with the aim of assessing the probability of test induced failures, the probability of failures to remain unrevealed and the potential to initiate transients because of errors performed in the test; (2) analysis of human actions during an operational transient: with the aim of assessing the probability that the operators will correctly diagnose the malfunctions and take proper corrective action. This report summarises the contributions received from the participants and analyses these contributions on a comparative basis. The aim of this analysis was to compare the procedures, modelling techniques and quantification methods used, to obtain insight in the causes and magnitude of the variability observed in the results, to try to identify preferred human reliability assessment approaches and to get an understanding of the current state of the art in the field identifying the limitations that are still inherent to the different approaches.

52982 (EUR–12356) **Human factors reliability Benchmark exercise: Summary Contributions of Participants.** Poucet, A. (ed.). Commission of the European Communities, Luxembourg (Luxembourg). Jun 1989. 490p. Source: NTIS (US Sales Only), PC A21/MF A01.

The Joint Research Centre of the European Commission has organized a Human Factors Reliability Benchmark Exercise (HF-RBE) with the aim of assessing the state of the art in human reliability modelling and assessment. Fifteen teams from eleven countries, representing industry, utilities, licensing organisations and research institutes, participated in the HF-RBE. The HF-RBE was organized around two study cases: (1) analysis of routine functional Test and Maintenance (T and M) procedures: with the aim of assessing the probability of test induced failures, the probability of failures to remain unrevealed and the potential to initiate transients because of errors performed in the test; (2) analysis of human actions during an operational transient: with the aim of assessing the probability that the operators will correctly diagnose the malfunctions and take proper corrective action. This report contains the final summary reports produced by the participants in the exercise.

52983 (EUR–12397) **General and preliminary thermohydraulic, hydrogen and aerosol instrumentation plan for the Phebus Fp-project.** Hampel, G. (Battelle - Institut e V. Frankfurt am Main (DE)); Poss, G.; Frohlich, H.K. Commission of the European Communities, Luxembourg (Luxembourg). Oct 1989. 207p. Contract No. 3209-87-07 ELISPD. Source: NTIS (US Sales Only), PC A10/MF A01.

The objective of the project was to draw up an instrumentation plan for the French core melting programme PHEBUS FP. This instrumentation plan essentially was to include proven and reliable instruments for recording various thermohydraulic, aerosol and hydrogen phenomena. The candidate measuring methods, which are known mainly from reactor safety programmes, have been described and examined for their usefulness in PHEBUS. Each method and instrument has been described in detail under various aspects such as measuring principle, measuring range, technical design, evaluation model, calibration procedure, accuracy, previous experience, commercial availability, etc. Special attention has been paid to the behaviour of the measuring transducers when exposed to radiation. First, the performance of the instruments was compared with the requirements of PHEBUS. The results of this comparison served as the basis for a measuring concept in tabular form, giving the locations of the measurements, the measuring tasks, and the number and kind of instruments that are recommended. Redundancy and cost-benefit aspects have been taken into account in qualitative terms.

52984 (EUR–12398) **Radionuclides measurements for the Phebus FP project - preliminary study.** Schuster, E. (Siemens A.G. Unternehmensbereich KWU Erlangen (DE)); Nopitsch, K. Commission of the European Communities, Luxembourg (Luxembourg). Sep 1989. 53p. Contract No. 3251-87-10 ELISPD. Source: NTIS (US Sales Only), PC A04/MF A01.

This report gives a review of proposed measurement techniques to measure quantitatively release and transport of fission products during and after fission product release tests. The measurement devices provided are for example gamma-spectrometers, scintillation counters and sampling vessels. The second part reviews the behaviour of fission product iodine under severe accident conditions and describes the iodine sampling system and the determination of iodine species in aqueous solutions.

52985 (EUR–12399) **Review of analytical techniques to determine the chemical forms of vapours and aerosols released from overheated fuel.** Bowsher, B.R. (UKAEA Atomic Energy Establishment Winfrith (UK). Chemistry Div.); Nichols, A.L. Commission of the European Communities, Luxembourg (Luxembourg). Dec 1989. 99p. Contract No. 3208-87-07 ELISPGB. Source: NTIS (US Sales Only), PC A05/MF A01.

A comprehensive review has been undertaken of appropriate analytical techniques to monitor and measure the chemical effects that occur in large-scale tests designed to study severe reactor accidents. Various methods have been developed to determine the chemical forms of the vapours, aerosols and deposits generated during and after such integral experiments. Other specific techniques have the long-term potential to provide some of the desired data in greater detail, although considerable efforts are still required to apply these techniques to the study of radioactive debris. Such in-situ and post-test methods of analysis have been also assessed in terms of their applicability to the analysis of samples from the Phebus-FP tests. The recommended in-situ methods of analysis are gamma-ray spectroscopy, potentiometry, mass spectrometry, and Raman/UV-visible absorption spectroscopy. Vapour/aerosol and deposition samples should also be obtained at well-defined time intervals during each experiment for subsequent post-test analysis. No single technique can provide all the necessary chemical data from these samples, and the most appropriate method of analysis involves a complementary combination of autoradiography, AES, IR, MRS, SEMS/EDS, SIMS/LMIS, XPS and XRD.

52986 (EUR–12434) **PISC II: Parametric studies monitoring of PISC-II parametric studies in ultrasonic NDT for PWR.** Toft, M.W. (Central Electricity Generating Board, Manchester (UK). NDT Applications Centre). Commission of the European Communities, Luxembourg (Luxembourg). Sep 1989. 25p. Contract No. 3047-86-10 PC ISP - GB. Source: NTIS (US Sales Only), PC A03/MF A01.

The CEGB NDT Applications Centre is partipating in the EEC-funded international Programme for the Inspection of Steel Components (PISC) on account of its relevance to the inspection of Sizewell B and future PWRs. This report describes an inspection monitoring exercise undertaken by NDTAC under partial funding from JRC Ispra, at the initiation of the PISC-III Ultrasonic Modelling Group. Experimental studies have been carried out under PISC-II to investigate ultrasonic defect response as a function of various parameters which characterise the inspection situation. Some of these parametric studies are potentially useful for the validation of theoretical models of ultrasonic inspection and are consequently relevant to the work of the PISC-III Modelling Group. The aim of the present exercise was to ensure that data obtained by the various contract organizations participating in the PISC-II Parametric Studies was of high quality, was a complete record of the inspection and would yield valid comparisons with the predictions of theoretical models. The exercise entailed visits by a nominated CEGB observer to 4 European NDT Laboratories at which the parametric studies were in progress; CISE (Milan); UKAEA (Harwell); UKAEA (Risley) and Vincotte (Brussels). This report presents the findings of those visits.

52987 (EUR–12488) **Eliciting and communicating expert judgments: methodology and application to nuclear safety.** von Winterfeldt, D. (Univ. of Southern California, Los Angeles, CA (US)). Commission of the European Communities, Luxembourg (Luxembourg). 1989. 43p. Source: NTIS (US Sales Only), PC A03/MF A01.

Expert judgment has always been used informally in the analysis of complex engineering problems. Increasingly, however, the use of expert judgment has been formalized by eliciting judgments in an explicit, documented and often quantitative way. In nuclear safety studies the need for formal elicitation of expert judgments arises because of the lack of data and experiences, the need to adapt model results to the specific circumstances of a plant, and the large uncertainties surrounding the events and quantities that characterize an accident sequence. The recognition of the need for a formal elicitation of expert judgments has led to one of the most

extensive expert elicitation processes to date in the context of the NUREG 1150 study. About 30 safety issues were quantified using expert judgments about probabilities of various uncertain events and quantities, ranging from the failure of a check valve in the cooling system to the pressure built up due to hydrogen production to release fractions of various radionuclides. In total, some 1000 probability distributions were elicited from some 50 experts. This paper first motivates the use of formal expert elicitation in complex engineering studies and describes the methodology of formal expert elicitation. Subsequently, it describes the overall approach of NUREG 1150 and provides an example of the elicitation of the probability of a bypass failure in a pressurized water reactor. The paper ends by discussing some lessons learned, problems encountered and by providing some recommendations.

52988 (EUR–12528) **Analysis of experiments of the University of Hannover with the Cathare code on fluid dynamic effects in the fuel element top nozzle area during refilling and reflooding.** Bestion, D. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (FR)). Commission of the European Communities, Luxembourg (Luxembourg). Nov 1989. 23p. Contract No. 3146-87-05 ELISPF. Source: NTIS (US Sales Only), PC A03/MF A01.

The CATHARE code is used to calculate the experiment of the University of Hannover concerning the flooding limit at the fuel element top nozzle area. Some qualitative and quantitativ limit at the fuel element top nozzle area. on both the actual fluid dynamics which is observed in the experiments and on the corresponding code behaviour. Shortcomings of the present models are clearly identified. New developments are proposed which should extend the code capabilities.

52989 (IWGFPT–33) **Ninth plenary meeting of the International Working Group on Water Reactor Fuel Performance and Technology Vienna, 2-4 October 1989: Summary report.** International Atomic Energy Agency, Vienna (Austria). International Working Group on Water Reactor Fuel Performance and Technology. Mar 1990. 108p. (CONF-8910471–: 9. plenary meeting of the International Working Group on Water Reactor Fuel Performance and technology, Vienna (Austria), 2-4 Oct 1989). Order Number DE91606027. Source: NTIS (US Sales Only), PC A06/MF A01; OSTI; INIS.

The 9th Plenary Meeting of the International Working Group on Water Reactor Fuel Performance and Technology (IWGFPT) was held in Vienna from 2 to 4 October 1989. The meeting was attended by 24 participants from 18 Member States and one international organization. This publication is a summary report of this meeting. It contains review of the IWGFPT activities of the period since the 8th meeting. The representatives of the Member States presented information about National Programs and multilateral projects status with emphasis on new results. Summary of the discussion on schedule of IWGFPT activities for the period of 1990-91 is also published in this report. Refs, figs and tabs.

52990 (JAERI-M–90-096) **Conceptual design study of high conversion light water reactor.** Okumura, Keisuke (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment); Akie, Hiroshi; Mori, Takamasa; Nakagawa, Masayuki; Ishiguro, Yukio. Japan Atomic Energy Research Inst., Tokyo (Japan). Jun 1990. 173p. (In Japanese). Order Number DE91713044. Source: NTIS (US Sales Only), PC A08/MF A01.

Since 1984, R and D work has been made for high conversion light water reactors (HCLWRs), at JAERI, to improve the natural uranium saving and effective plutonium utilization by the use of conventional or extended LWR technology. This report summarizes the results of the feasibility study made mainly from the viewpoint of nuclear design in the Phase-I Program (1985≈1989). Until now, the following various types of HCLWR core concepts have been investigated; (1) homogeneous core with tight pitch lattice of fuel rods, (2) homogeneous core with semi-tight pitch lattice, (3) spectral shift core using fertile rod with semi-tight pitch lattice, (4) flat-core, (5) axial heterogeneous core. The core burnup and thermohydraulic analyses during normal operations have been performed to clear up the burnup performances and feasibility for each core. Based on the analysis results, the axial heterogeneous HCLWR core was selected as the JAERI reference core. (author).

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Refer also to citation(s) 52733, 53061, 53064, 53065, 53066, 53067, 53068, 53069, 53221

52991 (Juel-Conf–71) **Proceedings of the workshop on structural design criteria for HTR.** Breitbach, G.; Schubert, F.; Nickel, H. (eds.). Kernforschungsanlage Juelich GmbH (Germany, F.R.). Apr 1989. 557p. (CONF-890186–: Workshop on structural design criteria for HTR, Julich (Germany, F.R.), 31 Jan - 1 feb 1989). Order Number DE91717019. Source: NTIS (US Sales Only), PC A24/MF A01.

The papers demonstrate the status of high temperature reactor technology with regard to its realization in the nuclear power industry of various countries (FRG, USA, Japan) as well as to the development of safety rules in Germany. The design criteria for HTR could be presented. The criteria already determine definitely and almost completely the relevant requirements of the component rules. The informations include the technical boundary conditions with regard to safety, the metallic high temperature components, a particular section dealing with the reactor pressure vessel, especially with the prestressed concrete vessel, and the structural graphite components. (DG).

52992 (Juel-Conf–71, pp. 15-32) **Present status of MHTGR program in USA. Compiled from contributions from the MHTGR Program Team.** Rittenhouse, P.L. Kernforschungsanlage Juelich GmbH (Germany, F.R.). Apr 1989. Contract DE-AC05-84OR21400. (CONF-890186–: Workshop on structural design criteria for HTR, Julich (Germany, F.R.), 31 Jan - 1 feb 1989). In *Proceedings of the workshop on structural design criteria for HTR.* 557p. Order Number DE91717019. Source: NTIS (US Sales Only), PC A24/MF A01.

The U.S. Department of Energy (DOE) Modular High-Temperature Gas-Cooled Reactor (MHTGR) program has produced a conceptual design which has been reviewed by the U.S. Nuclear Regulatory Commission (NRC). The results of the review were generally favorable, and the program team has now moved into the preliminary design phase. The program team consists of a nuclear island engineering (NIE) team, an energy conversion area (ECA) team, a design integration organization, and a technology development team. Utility user requirements are provided by a utility organization which also participates in design and programmatic reviews/evaluations. This paper will review the direction and accomplishments of each participating organization. (orig.).

52993 (Juel-Conf–71, pp. 33-47) **Present status of HTTR project in Japan.** Tanaka, Toshiyuki (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). HTTR Designing Lab.); Saito, Shinzo. Kernforschungsanlage Juelich GmbH (Germany, F.R.). Apr 1989. (CONF-890186–: Workshop on structural design criteria for HTR, Julich (Germany, F.R.), 31 Jan - 1 feb 1989). In *Proceedings of the workshop on structural design criteria for HTR.* 557p. Order Number DE91717019. Source: NTIS (US Sales Only), PC A24/MF A01.

In Japan, the research and development on the HTR had been carried out for more than fifteen years as the multi-purpose VHTR program for direct utilization of nuclear process heat such as nuclear steel making. Recently, reflecting the change of social and energy situation and with no incentives for industries to introduce such in the near future, the JAERI has changed them for more basic 'HTTR program' to establish the HTR technology basis and upgrade them. At the request of the STA the Reactor Safety Research Association has reviewed the safety evaluation guideline and started the work on the establishment of general design criteria and design code or guide for graphite and high-temperature structure of the HTTR. Construction permit of the HTTR will be issued by the Government early in 1990. (orig./DG).

52994 (Juel-Conf–71, pp. 48-58) **HTR-situation in China.** Wang, D. (Institute of Nuclear Energy Technology, Beijing, BJ (China)); Xu, S. Kernforschungsanlage Juelich GmbH (Germany, F.R.). Apr 1989. (CONF-890186–: Workshop on structural design criteria for HTR, Julich (Germany, F.R.), 31 Jan - 1 feb 1989). In *Proceedings of the workshop on structural design criteria for HTR.*

557p. Order Number DE91717019. Source: NTIS (US Sales Only), PC A24/MF A01.

Research on HTR technology can be divided into two stages in China. The first stage is from 1975 to 1978. The main aim was to look into the possibility of using HTR as a high convertor as well as a power producer. Various aspects of HTR technology have been investigated. The second stage started in 1984. At the beginning of the stage, the main activities include: - feasibility study of using HTR in China, - R and D of HTR technology, - establishing international exchange and cooperation. On the basis of these activities, HTR technology has been put into the state's high technology programme and is carring out by the institutions from the whole country. International cooperation with KFA, and German industry is widened and deepened. A joint programme has been set up to build a 10 MW test module HTR at INET, China. (orig.).

52995 (Juel-Conf–71, pp. 59-79) **Present status of the high temperature reactor in the Federal Republic of Germany.** Nickel, H. (Kernforschungsanlage Juelich GmbH (Germany, F.R.). Inst. fuer Reaktorwerkstoffe). Kernforschungsanlage Juelich GmbH (Germany, F.R.). Apr 1989. (CONF-890186–: Workshop on structural design criteria for HTR, Julich (Germany, F.R.), 31 Jan - 1 feb 1989). In *Proceedings of the workshop on structural design criteria for HTR.* 557p. Order Number DE91717019. Source: NTIS (US Sales Only), PC A24/MF A01.

At the present time, two HTR concepts are being followed up by German companies, a small HTR (approx. 200 MW_{th}) with a steel pressure vessel and a medium-sized reactor (approx. 550 MW_{el}) with a prestressed concrete pressure vessel for electricity generation. The special safety features of the HTR originate in the core construction of ceramic materials resistant to high temperatures and the low power density of the core. An analysis of the technical safety features shows that the general activity containment concepts developed for light-water reactors (LWR) are not transferable to the HTR. It was necessary to develop technical safety concepts especially for the HTR, and the result is the HTR integrity concept. Licensing procedures have been established for the design, construction and commissioning of the prototype THTR 300 and invaluable experience gained. A concept for licensing approval of the HTR module plants, independent of the siting of the nuclear plant, is now being investigated. (orig.).

52996 (Juel-Conf–71, pp. 113-132) **Metallurgical and physical fundamentals for the design of high temperature components.** Schubert, F. (Kernforschungsanlage Juelich GmbH (Germany, F.R.). Inst. fuer Reaktorwerkstoffe). Kernforschungsanlage Juelich GmbH (Germany, F.R.). Apr 1989. (CONF-890186–: Workshop on structural design criteria for HTR, Julich (Germany, F.R.), 31 Jan - 1 feb 1989). In *Proceedings of the workshop on structural design criteria for HTR.* 557p. Order Number DE91717019. Source: NTIS (US Sales Only), PC A24/MF A01.

Thermally induced, strain-controlled fatigue exposure produces, depending on temperature and strain rate, kinematic hardening or softening, whereby some proportion of the strain is creep or relaxation controlled. For specific parts of the steam generator, the live steam circuit, heat exchangers and hot ducts, creep resistant steels (13 CrMoV 44) and alloys (Incoloy 800) are required to prevent time-dependent failure modes, such as creep deformation and damage, creep-fatigue, exhaustion and damage, microstructural instabilities, excessive high temperature corrosion and, for some components, loss of deformability due to neutron irradiation. The metallurgical understanding behind all the failure modes are discussed. The principle demands for the design of all components operating at elevated and high temperatures are the limitation of total remaining creep strains and the avoidance of localized plastic and creep strains. (orig./DG).

52997 (Juel-Conf–71, pp. 133-158) **Load levels, stresses, failure modes and design criteria.** Bieniussa, K. (Gesellschaft fuer Reaktorsicherheit mbH (GRS), Koeln (Germany, F.R.)); Reck, H. Kernforschungsanlage Juelich GmbH (Germany, F.R.). Apr 1989. (CONF-890186–: Workshop on structural design criteria for HTR, Julich (Germany, F.R.), 31 Jan - 1 feb 1989). In *Proceedings of the workshop on structural design criteria for HTR.* 557p. Order Number DE91717019. Source: NTIS (US Sales Only), PC A24/MF A01.

The design criteria for metallic components which are to be used in the high-temperature range were described by way of example. The time-dependent material behavior in this temperature range requires safeguarding against time-dependent kinds of failure, provision of time-dependent material data, and consideration of the time-dependent loads. The design criteria elaborated as well as the available material data permit a design of the components that can withstand the loads for the planned operating lifetimes. (orig./DG).

52998 (Juel-Conf–71, pp. 159-170) **Basic requirements relating to quality assurance of safety related HTR materials and components.** Just, J. (Rheinisch-Westfaelischer Technischer Ueberwachungs-Verein e.V., Essen (Germany, F.R.)). Kernforschungsanlage Juelich GmbH (Germany, F.R.). Apr 1989. (CONF-890186–: Workshop on structural design criteria for HTR, Julich (Germany, F.R.), 31 Jan - 1 feb 1989). In *Proceedings of the workshop on structural design criteria for HTR.* 557p. Order Number DE91717019. Source: NTIS (US Sales Only), PC A24/MF A01.

All the quality assurance elements shown in the first figure must not be regarded separately from one another. Only their planned and harmonized interaction will achieve the objective that highly stressed high temperature components will be fabricated with just as great a freedom from manufacturing defects and will be operated with as little danger of catastrophic failure as LWR components which are comparable with regard to safety and which have proven themselves over an accumulated period of more than two hundred operating years. (orig.).

52999 (Juel-Conf–71, pp. 171-184) **Non-destructive detection of flaws during manufacture and operation of components.** Walte, F. (Fraunhofer-Institut fuer Zerstoerungsfreie Pruefverfahren, Saarbruecken (Germany, F.R.)). Kernforschungsanlage Juelich GmbH (Germany, F.R.). Apr 1989. (CONF-890186–: Workshop on structural design criteria for HTR, Julich (Germany, F.R.), 31 Jan - 1 feb 1989). In *Proceedings of the workshop on structural design criteria for HTR.* 557p. Order Number DE91717019. Source: NTIS (US Sales Only), PC A24/MF A01.

The nondestructive testing (NDT) in the field of quality assurance of components in the light water reactor (LWR) technology is today very well established, nevertheless not all NDT methods are transformable to the case of high temperature reactor (HTR) components. The reason is the coarse grain structure of the austenitic material used in the HTR-technology in opposite to the fine grain structure in the case of ferritic material in the LWR-technology. Mainly the ultrasonic (UT) testing, which plays the dominant rule in the LWR inspection, is influenced by the coarse grain austenitic or nickel base alloys structure. The present article analyses the influence of the coarse grain especially the dendritic structure in welds of austenitic and nickel base alloys, discusses methods and ways to detect flaws in austenitic and dissimilar welds and gives a practicable rule for NDT in the field of HTR components with a combination of ultrasonic and X-ray inspection techniques. (orig.).

53000 (Juel-Conf–71, pp. 185-205) **Material data and constitutive equations.** Penkalla, H.J. (Kernforschungsanlage Juelich GmbH (Germany, F.R.). Inst. fuer Reaktorwerkstoffe). Kernforschungsanlage Juelich GmbH (Germany, F.R.). Apr 1989. (CONF-890186–: Workshop on structural design criteria for HTR, Julich (Germany, F.R.), 31 Jan - 1 feb 1989). In *Proceedings of the workshop on structural design criteria for HTR.* 557p. Order Number DE91717019. Source: NTIS (US Sales Only), PC A24/MF A01.

Material data and constitutive equations form the basis for the determination of design values and for the inelastic analysis of the component behaviour under complex loading conditions. For metallic HTR components the materials NiCr 23 Co 12 Mo (Alloy 617), X 10 NiCrAlTi 32 20 (Alloy 800) and X 20 CrMoV 12 1 are selected. The material data are obtained from the test results of different material investigations programmes. Due to the high application temperatures for metallic HTR components, the main part of the material data consists of creep and fatigue properties. Additional material data are the physical properties, short term properties and fracture mechanics properties. The evaluated data are presented in material data sheets. (orig.).

53001 (Juel-Conf–71, pp. 243-274) **The present status of research and development works for the preparation of the high**

temperature design code. Muto, Y.; Kaji, Y.; Miyamoto, Y.; Nakajima, H.; Baba, O. Kernforschungsanlage Juelich GmbH (Germany, F.R.). Apr 1989. (CONF-890186--: Workshop on structural design criteria for HTR, Julich (Germany, F.R.), 31 Jan - 1 feb 1989). In *Proceedings of the workshop on structural design criteria for HTR.* 557p. Order Number DE91717019. Source: NTIS (US Sales Only), PC A24/MF A01.

A structural design code for the HTTR components is prepared in JAERI based on rules of both the Elevated-Temperature Structural Design Guide for Monju and the ASME Code Case N-47 and on material data of Hastelloy XR. Research and development works have been conducted to ascertain the validity of the rules for the material and loads in the service condition of HTTR. These works consist of creep tests, creep-fatigue tests, biaxial creep tests, weldment tests and component tests. Test objectives, test parameters, test apparatuses and time schedules for these are introduced. In addition, some test results are described. A tertiary creep behavior and creep-damage criterion are discussed based on a stress-controlled creep test of Hastelloy XR at 900deg C. Creep-fatigue life-prediction methods are compared using fatigue-test results with both fast and slow strain rates or with both tension and compression hold times. A result of bending creep-fatigue test of heat transfer tubes is described. (orig.).

53002 (Juel-Conf–71, pp. 275-292) **Creep rupture characteristics in the HTGR simulated helium gas environment and their relevance to structural design.** Kurata, Y. (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Dept. of Fuels and Materials Research (Japan)); Ogawa, Y.; Nakajima, H.; Kondo, T. Kernforschungsanlage Juelich GmbH (Germany, F.R.). Apr 1989. (CONF-890186--: Workshop on structural design criteria for HTR, Julich (Germany, F.R.), 31 Jan - 1 feb 1989). In *Proceedings of the workshop on structural design criteria for HTR.* 557p. Order Number DE91717019. Source: NTIS (US Sales Only), PC A24/MF A01.

Creep rupture characteristics in the HTGR simulated helium gas environment and their relevance to structural design are described for Hastelloy XR and Hastelloy XR-II, versions of Hastelloy X modified for nuclear applications. The results of creep and corrosion tests in several kinds of helium environments with different impurity compositions are presented. Corrosion data are analyzed to clarify the corrosion mechanism and estimate the long-term corrosion effect in the HTGR helium. Creep data obtained under refined conditions make clear the effect of decarburization, carburization and oxidation on creep behaviour. On the basis of the results obtained in this study the range of gas composition is defined where decarburization and rapid carburization cannot occur for the alloys at 950deg C. A data base which allows high temperature structural design for HTGR has been obtained in a standardized HTGR simulated gas. (orig.).

53003 (Juel-Conf–71, pp. 293-308) **Assessment of primary and secondary stresses for component design.** Bodmann, E. (Hochtemperatur-Reaktorbau GmbH, Mannheim (Germany, F.R.)). Kernforschungsanlage Juelich GmbH (Germany, F.R.). Apr 1989. (CONF-890186--: Workshop on structural design criteria for HTR, Julich (Germany, F.R.), 31 Jan - 1 feb 1989). In *Proceedings of the workshop on structural design criteria for HTR.* 557p. Order Number DE91717019. Source: NTIS (US Sales Only), PC A24/MF A01.

We investigated three design methods which are based on the assumption of a sufficiently ductile material. It was possible to show in all three cases, that creep as a predominant or additional material effect does not influence the validity of these methods. Moreover it has been shown that plasticity and creep can be treated uniformly. Creep can be considered as time dependent plasticity with respect to the macroscopic effect of inelastic strain. The time dependence however does not affect these design methods. (orig.).

53004 (Juel-Conf–71, pp. 309-328) **Elastic and inelastic analysis of component behaviour.** Seehafer, H.J. (Internationale Atomreaktorbau GmbH (INTERATOM), Bergisch Gladbach (Germany, F.R.)). Kernforschungsanlage Juelich GmbH (Germany, F.R.). Apr 1989. (CONF-890186--: Workshop on structural design criteria for HTR, Julich (Germany, F.R.), 31 Jan - 1 feb 1989). In *Proceedings of the workshop on structural design criteria for HTR.* 557p. Order Number DE91717019. Source: NTIS (US Sales Only), PC A24/MF A01.

Criteria for defining the time and temperature dependent area of creep relevance are discussed by presenting corresponding creep-cross-over curves for the materials (X20 CrMoV 121; X10 NiCrAlTi 3220; NiCr22 Co12 Mo) ensuring component design against creep failure without performing any inelastic analysis. The application of these creep-cross-over curves is restricted to normal loading conditions and does not consider possible fatigue failures where hold time effects may become significant. Stress intensity factors for selected conditions and for particular material behaviour have been determined, thus enabling the performance of simplified elastic-plastic analyses. Compared to ASME recommendations, significant differences depending on stress level have been identified. The practical importance of this procedure is related to assessments of peak stresses due to notches and geometrical discontinuities. (orig./DG).

53005 (Juel-Conf–71, pp. 329-345) **Significance of fracture mechanics.** Schneider, K. (Asea Brown Boveri AG, Mannheim (Germany, F.R.)). Kernforschungsanlage Juelich GmbH (Germany, F.R.). Apr 1989. (CONF-890186--: Workshop on structural design criteria for HTR, Julich (Germany, F.R.), 31 Jan - 1 feb 1989). In *Proceedings of the workshop on structural design criteria for HTR.* 557p. Order Number DE91717019. Source: NTIS (US Sales Only), PC A24/MF A01.

Examples indicated that comprehensive fracture mechanics considerations may be successful on the basis of the special design criteria of HTR components. Especially the proof of negligible crack growth for the relevant materials at corresponding reference temperatures should be covered by design criteria in the creep regime. A stepwise procedure for the proof of rupture exclusion is proposed. In the case that the conditions for rupture exclusion are not met in the first step material or component specific considerations may be applied at reasonable expense. If even individual verifications do not meet the demands for rupture exclusion either service restriction and service monitoring or design review is necessary. (orig./DG).

53006 (Juel-Conf–71, pp. 349-369) **Design criteria for prestressed concrete pressure vessels.** Schimmelpfennig, K. (Stangenberg, Schnellenbach und Partner Gemeinschaft Beratender Ingenieure GmbH, Bochum (Germany, F.R.)). Kernforschungsanlage Juelich GmbH (Germany, F.R.). Apr 1989. (CONF-890186--: Workshop on structural design criteria for HTR, Julich (Germany, F.R.), 31 Jan - 1 feb 1989). In *Proceedings of the workshop on structural design criteria for HTR.* 557p. Order Number DE91717019. Source: NTIS (US Sales Only), PC A24/MF A01.

The work concerned with the PCRVs has been focussed on topics which are not sufficiently covered by the usual codes with respect to the special structure of PCRVs and the special demands on it, and different investigations yielding a basis for such specific design criteria have been carried out. Only a couple of subjects being in the fore under the aspect of defining quality enlarging design criteria for PCRVs are outlined. The materials for the concrete to be used for the PCRVs are carefully selected. (DG).

53007 (Juel-Conf–71, pp. 370-384) **Design criteria for liners of concrete vessels.** Oberpichler, R. (Stangenberg, Schnellenbach und Partner Gemeinschaft Beratender Ingenieure GmbH, Bochum (Germany, F.R.)). Kernforschungsanlage Juelich GmbH (Germany, F.R.). Apr 1989. (CONF-890186--: Workshop on structural design criteria for HTR, Julich (Germany, F.R.), 31 Jan - 1 feb 1989). In *Proceedings of the workshop on structural design criteria for HTR.* 557p. Order Number DE91717019. Source: NTIS (US Sales Only), PC A24/MF A01.

The composite liner for HTR-500 can be expected highly safe against failure as long as the global integrity of the composite structure 'steel liner + anchorage + concrete structure' can be guaranteed. Therefore the reliability of the composition between the liner plate and the concrete structure is of great importance for designing the liner anchor system. That means the anchorage concept with regard to type, size and arrangement of the anchors, the connection of the anchors to the liner plate and the embedding of the anchors themselves in the concrete are responsible for the composition between liner and concrete. Thus, design criteria for

analysing and fabricating a composite liner have been worked out which predominantly have to guarantee a safe anchorage. Standard proposals for several design details concerning material, analysis, construction and testing of the composite liner have been worked out. (orig./DG).

53008 (Juel-Conf–71, pp. 385-403) **Special features of the design of pressure vessel closures and heat insulations.** Pschowski, J. (Hochtemperatur-Reaktorbau GmbH, Mannheim (Germany, F.R.)). Kernforschungsanlage Juelich GmbH (Germany, F.R.). Apr 1989. (CONF-890186–: Workshop on structural design criteria for HTR, Julich (Germany, F.R.), 31 Jan - 1 feb 1989). In *Proceedings of the workshop on structural design criteria for HTR.* 557p. Order Number DE91717019. Source: NTIS (US Sales Only), PC A24/MF A01.

Based on realistic design data different anchor concepts were analysed for the transitional areas between the penetration liner and the vessel closure. Making use of the basis safety criteria an integrity concept has been developed in connection with the double closure design, which meets the specific HTR-500 conditions. The effect of the failure on the load-carrying behaviour of the PCRV and on the leak tightness of the liner was evaluated. Strength analyses were carried out and the fracture mechanics of the failure mechanism was evaluated. (DG).

53009 (Juel-Conf–71, pp. 404-441) **The HTR-module pressure vessel unit, design criteria and safety philosophy.** Neumann, G. (Siemens AG Unternehmensbereich KWU, Erlangen (Germany, F.R.)); Heidt, K.; Dumm, K.; Rothfuss, H. Kernforschungsanlage Juelich GmbH (Germany, F.R.). Apr 1989. (CONF-890186–: Workshop on structural design criteria for HTR, Julich (Germany, F.R.), 31 Jan - 1 feb 1989). In *Proceedings of the workshop on structural design criteria for HTR.* 557p. Order Number DE91717019. Source: NTIS (US Sales Only), PC A24/MF A01.

The pressure vessel unit of the HTR module can make use of experience gained from the construction and operation of reactor coolant system components of light water reactors. Therefore proven techniques and accepted codes and standards are available for all aspects such as design, material, manufacture, inspection, operational monitoring, and inservice inspection. At the same time, the safety concept of light water reactor primary system components against catastrophic failure, which is characterized by multiple redundancies, can be applied in full. This means that the integrity of the pressure vessel unit of the HTR module is assured for the total lifetime. (orig./DG).

53010 (Juel-Conf–71, pp. 467-479) **Materials behaviour and design values.** Haag, G. (Forschungszentrum Juelich GmbH (Germany, F.R.). Inst. fuer Reaktorwerkstoffe). Kernforschungsanlage Juelich GmbH (Germany, F.R.). Apr 1989. (CONF-890186–: Workshop on structural design criteria for HTR, Julich (Germany, F.R.), 31 Jan - 1 feb 1989). In *Proceedings of the workshop on structural design criteria for HTR.* 557p. Order Number DE91717019. Source: NTIS (US Sales Only), PC A24/MF A01.

In structural design criteria for high temperature reactors graphite has to be regarded as a material of its own which is significantly different from other construction materials. To guarantee the quality of graphitic materials, it is necessary to verify the properties of raw materials, to survey the production process and to control the final product properties. Designing graphitic reactor components one has to take into account problems that may arise from corrosion and from fast neutron radiation effects. Consequently, physical properties such as dimensional stability, Young's modulus, tensile strength, thermal conductivity, thermal expansivity and coefficient of irradiation induced creep have to be observed as a function of neutron fluence in irradiation experiments. (orig.).

53011 (Juel-Conf–71, pp. 480-492) **Design methods and criteria for graphite components.** Schmidt, A. (Hochtemperatur-Reaktorbau GmbH, Mannheim (Germany, F.R.)). Kernforschungsanlage Juelich GmbH (Germany, F.R.). Apr 1989. (CONF-890186–: Workshop on structural design criteria for HTR, Julich (Germany, F.R.), 31 Jan - 1 feb 1989). In *Proceedings of the workshop on structural design criteria for HTR.* 557p. Order Number DE91717019. Source: NTIS (US Sales Only), PC A24/MF A01.

Criteria have been established on the basis of the THTR licensing procedure and a material research and development programme for the design of graphite internals of an HTR-500. The components were classified into classes according to their special functions; the loads applied to the components were classified into load levels depending on their occurrence probability. For evaluating the stresses the Weibull theory was used. Allowable failure probabilities are defined rather than allowable stresses. This evaluation method can be applied to any stress state. (orig.).

53012 (Juel-Spez–565) **Irradiation behaviour of advanced fuel elements for the helium-cooled high temperature reactor (HTR).** Nickel, H. Forschungszentrum Juelich GmbH (Germany, F.R.). Inst. fuer Reaktorwerkstoffe. May 1990. 22p. (CONF-900634–: 7. world ceramics congress: ceramics today–tomorrow's ceramics, Montecatini Terme (Italy), 24-30 Jun 1990). Order Number DE91717161. Source: NTIS (US Sales Only), PC A03/MF A01.

The design of modern HTRs is based on high quality fuel. A research and development programme has demonstrated the satisfactory performance in fuel manufacturing, irradiation testing and accident condition testing of irradiated fuel elements. This report describes the fuel particles with their low-enriched UO_2 kernels and TRISO coating, i.e. a sequence of pyrocarbon, silicon carbide, and pyrocarbon coating layers, as well as the spherical fuel element. Testing was performed in a generic programme satisfying the requirements of both the HTR-MODUL and the HTR 500. With a coating failure fraction less than $2x10^{-5}$ at the 95% confidence level, the results of the irradiation experiments surpassed the design targets. Maximum accident temperatures in small, modular HTRs remain below 1600deg C, even in the case of unrestricted core heatup after depressurization. Here, it was demonstrated that modern TRISO fuels retain all safety-relevant fission products and that the fuel does not suffer irreversible changes. Isothermal heating tests have been extended to 1800deg C to show performance margins. Ramp tests to 2500deg C demonstrate the limits of present fuel materials. A long-term programme is planned to improve the statistical significance of presently available results and to narrow remaining uncertainty limits. (orig.).

53013 (ORNL/FTR–3687) **[Fuel, fission product, and graphite technology]: Foreign trip report, July 10, 1990–July 20, 1990.** Stansfield, O.M. Oak Ridge National Lab., TN (USA). 25 Jul 1990. 49p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE91001155. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Travel to the Forschungszentrum (KFA) – Juelich described in this report was for the purpose of participating in the annual meeting of subprogram managers for the US/DOE Umbrella Agreement for Fuel, Fission Product, and Graphite Technology. At this meeting the highlights of the cooperative exchange were reviewed for the time period June 1989 through June 1990. The program continues to contribute technology in an effective way for both countries. Revision 15 of the Subprogram Plan will be issued as a result of the meeting. There was interest expressed by KFA management in the level of support received from the NPR program and in potential participation in the COMEDIE loop experiment being conducted at the CEA.

2104 Power Reactors, Nonbreeding, Otherwise Moderated or Unmoderated

Refer also to citation(s) 53072, 53073, 54179

53014 (DPST–64-120) **New burnout correlation for annuli.** Towell, R.H. Savannah River Lab., Aiken, SC (USA). Technical Div. 26 Mar 1964. 23p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC09-89SR18035. Order Number DE91000781. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A number of burnout tests have been run subsequent to the publication of the burnout equations in DP-355 and DP-725. The range of variables was extended in these tests and the burnout heat flux was measured. This memorandum presents a modified empirical equation, which correlates the new data, for use in the design of fuel assemblies for the HWCTR. We expect to submit this material for a journal publication within the next quarter.

53015 (MIC–90-04393/XAB) **Rejection index for pressure tubes. Research report No. INFO-0323.** Mitchell, A.B.; Meneley, D. Atomic Energy Control Board, Ottawa, ON (Canada). ©1989. 96p. Source: NTIS, PC EE12/MF E01.

Study to establish a set of criteria (or rejection index) which could be used to decide whether a zirconium-2 1/2 w/o niobium pressure tube in a CANDU reactor should be removed from service due to in-service degradation. Background information on pressure tube failure events in Canada and worldwide; metallurgical degradation of zirconium alloy pressure tubes in reactor service; leak-before-break and other safety philosophies; pre-service and in-service inspection practices; and current requirements for periodic inspection of pressure tubes was collected. On the basis of this background information, a critique of key issues associated with establishing a realistic rejection index was prepared. Areas of uncertainty in available information were identified and recommendations for further analysis and laboratory testing made.

2105 Power Reactors, Breeding

Refer also to citation(s) 53058

53016 (EUR–12669) **LMFBR safety criteria and guidelines for consideration in the design of future plants.** Commission of the European Communities, Luxembourg (Luxembourg). 1990. 50p. Source: NTIS (US Sales Only), PC A03/MF A01.

For many years the Commission of the European Communities has been conducting activities aimed at the progressive harmonization of safety requirements and criteria applied to nuclear installations in the Community. These activities cover thermal and fast reactors. This publication represents a major achievement in reaching this goal. The document, which has been prepared in the framework of activities of the CEC fast-reactor safety working group (SWG), consists of safety criteria and guidelines for fast reactors. It represents the common view of all EC Member States which have a fast-reactor programme or are interested in fast-reactor development. The criteria and guidelines are structured according to different types of possible faults, such as core reactivity faults, general cooling faults, subassembly faults, faults outside the core and causes external to the station. Only those events are considered which are in the design basis of current fast-reactor projects. Proposed measures or guidelines to satisfy the criteria are based on the present knowledge and proven technology.

53017 (ORNL/TM–11161) **Low-order dynamic modeling of the Experimental Breeder Reactor II.** Berkan, R.C. (Tennessee Univ., Knoxville, TN (USA). Dept. of Nuclear Engineering); Upadhyaya, B.R.; Kisner, R.A. Oak Ridge National Lab., TN (USA). Jul 1990. 122p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC05-84OR21400. Order Number DE91000524. Source: NTIS, PC A07/MF A01; OSTI; INIS; GPO Dep.

This report describes the development of a low-order, linear model of the Experimental Breeder Reactor II (EBR-II), including the primary system, intermediate heat exchanger, and steam generator subsystems. The linear model is developed to represent full-power steady state dynamics for low-level perturbations. Transient simulations are performed using model building and simulation capabilities of the computer software Matrix$_x$. The inherently safe characteristics of the EBR-II are verified through the simulation studies. The results presented in this report also indicate an agreement between the linear model and the actual dynamics of the plant for several transients. Such models play a major role in the learning and in the improvement of nuclear reactor dynamics for control and signal validation studies. This research and development is sponsored by the Advanced Controls Program in the Instrumentation and Controls Division of the Oak Ridge National Laboratory. 17 refs., 67 figs., 15 tabs.

53018 (Risley-Trans–5944) **Cooperation: On the road to the Euro-Breeder.** Marth, W. (Kernforschungszentrum Karlsruhe GmbH (Germany, F.R.). Projekt Schneller Brueter). UKAEA Northern Research Labs., Risley (UK). [1989]. 16p. Translation of Atomwirtschaft (May 1989), v. 34(5) p. 217-221. Source: Available from The British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

Translation of Atomwirtschaft (May 1989), v. 34(5) p. 217-221.

Concerted European action in the field of Fast Reactor development became a reality on 16.2.89., with the signing of a number of agreements in Bonn. Their objective is to transform the various national Breeder variants into a common concept and to develop and build a European Breeder Reactor. For this European Fast Reactor (EFR), research institutions and industrial undertakings from West Germany, France and Great Britain have agreed a research and development programme, the work being shared and appropriate to the individual partners; at the industrial level, German, French and British undertakings are cooperating in the planning and construction. Italy, Belgium and the Netherlands are also contributing to certain areas of the project. (author).

53019 (WHC-SA–0924) **Techniques for cutting irradiated fuel ducts at FFTF/IEM cell.** Payzant, W.H. Westinghouse Hanford Co., Richland, WA (USA). Sep 1990. 6p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC06-87RL10930. (CONF-901101–41: American Nuclear Society winter meeting, Washington, DC (USA), 11-15 Nov 1990). Order Number DE91001288. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

Two remotely controlled mill-type cutters have been used in the Fast Flux Test Facility Interim Examination and Maintenance Cell to assist in the disassembly of 18 fuel assemblies. These cutters slit the outer duct of the fuel assemblies, which allows the ducts to be removed and provides access to the encased fuel pins. The cutters were developed by Westinghouse Hanford Company and thoroughly tested by cutting prototypic ducts. During actual use, however, occasional loss of cutting depth control occurred. A discussion of the control problems and the operation and design techniques developed for their resolution is presented. 3 refs., 7 figs.

53020 (WHC-SA–0948) **Remote replacement of Materials Open-Test Assembly specimens at the FFTF IEM cell.** Gibbons, P.W.; Ramsey, E.B. Westinghouse Hanford Co., Richland, WA (USA). Oct 1990. 16p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC06-87RL10930. (CONF-901101–38: American Nuclear Society winter meeting, Washington, DC (USA), 11-15 Nov 1990). Order Number DE91001281. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The Fast Flux Test Facility (FFTF) Interim Examination and Maintenance (IEM) Cell is used for the remote disassembly of irradiated fuel and material experiments. Materials Open-Test Assemblies (MOTA) are brought to the IEM Cell where their outer ducts are removed, exposing the test train for material-specimen removal. The specimens are shipped to the materials laboratory for sorting. Some are selected for testing while the rest, along with new specimens, are loaded in new specimen holders and returned within ten days to the IEM Cell where they are placed in the test train of new MOTA vehicles. Installation of the outer ducts readies the MOTA's for further specimen irradiation. This presentation discusses remote equipment and techniques used in this process. 11 figs.

53021 (WHC-SA–0954) **Fast Flux Test Facility interim examination and maintenance cell: Past, present, and future.** Vincent, J.R. Westinghouse Hanford Co., Richland, WA (USA). Sep 1990. 14p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC06-87RL10930. Order Number DE91001188. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The Fast Flux Test Facility Interim Examination and Maintenance Cell was designed to perform interim examination and/or disassembly of experimental core components for final analysis elsewhere, as well as maintenance of sodium-wetted or neutron-activated internal reactor parts and plant support hardware. The Interim Examination and Maintenance Cell equipment developed and used for the first ten years of operation has been primarily devoted to the disassembly and examination of core component test assemblies. While no major reactor equipment has required remote repair or maintenance, the Interim Examina Examination and Maintenance Cell has served as the remote repair facility for its own in-cell equipment, and several innovative remote repairs have been accomplished. The Interim Examination and Maintenance Cell's demonstrated versatility has shown its capability to support a challenging future. 12 refs., 9 figs.

2107 Regulation and Licensing

Refer also to citation(s) 52995, 53066

53022 (CDTN–ASPC.CN-001/89, pp. 150-157) **Semi-annual report of the licensing program - July to December 1988.** Centro de Desenvolvimento da Tecnologia Nuclear (CDTN), Belo Horizonte, MG (Brazil). 1989. (In Portuguese). In *Semi-annual report of Nuclear Technology and Development Center (CDTN) - July to December 1988.* 353p. Order Number DE91606188. Source: NTIS (US Sales Only), PC A16/MF A01; OSTI; INIS.

The main activities developed and described are: licensing of CIPC (FSAR), emergency plan of NUCLEI, reevaluation of the maximum credible accident of NUCLEI, updating of the safety analysis report of CDTN, emergency plan of IPR-R1 reactor and licensing of the DIENR.CN. installations. (E.G.).

53023 (MIC–90-04395/XAB) **Preliminary review of training materials. Research report No. INFO-0336.** Cote, A. Atomic Energy Control Board, Ottawa, ON (Canada). ©1988. 10p. Source: NTIS, PC EE07/MF E01.

Description of a research project which developed a methodology to evaluate the effectiveness of Atomic Energy Control Board licensee training materials. In addition, the professional resources required were identified and the costs of the total study and its constituent sections were estimated.

53024 (NUREG–0540-Vol.12-No.8) **Title list of documents made publicly available, August 1–31, 1990: Volume 12, No. 8.** Nuclear Regulatory Commission, Washington, DC (USA). Div. of Freedom of Information and Publications Services. Oct 1990. 314p. Sponsored by Nuclear Regulatory Commission. Source: NTIS, PC A14/MF A01 - GPO; OSTI; INIS.

This monthly publication contains descriptions of the information received and generated by the US Nuclear Regulatory Commission (NRC). This information includes (1) docketed material associated with civilian nuclear power plants and other uses of radioactive materials and (2) nondocketed material received and generated by NRC pertinent to its role as a regulatory agency. As used here, docketed does not refer to Court dockets; it refers to the system by which NRC maintains its regulatory records. This series of documents is indexed by a Personal Author Index, a Corporate Source Index, and a Report Number Index. The docketed information contained in the Title List includes the information formerly issued through the Department of Energy publication Power Reactor Docket Information, last published in January 1979.

53025 (NUREG–0750-Vol.32-No.2) **Nuclear Regulatory Commission Issuances, August 1990: Volume 32, No. 2.** Nuclear Regulatory Commission, Washington, DC (USA). Div. of Freedom of Information and Publications Services. Aug 1990. 79p. Sponsored by Nuclear Regulatory Commission. Source: NTIS, PC A05/MF A01 - GPO; OSTI; INIS.

This report includes the issuances received during the specified period from the Commission (CLI), the Atomic Safety and Licensing Appeal Boards (ALAB), the Atomic Safety and Licensing Boards (LBP), the Administrative Law Judge (ALJ), the Directors' Decisions (DD), and the Denials of Petitions for Rulemaking (DPRM).

2108 Economics

Refer also to citation(s) 52976, 53117

22 NUCLEAR REACTOR TECHNOLOGY

2201 Theory and Calculation

Refer also to citation(s) 53040, 53088

2202 Components and Accessories

Refer also to citation(s) 53080, 53089, 53406

53026 (AEEW-M–2591) **Progress in modelling reinforced concrete structures in DYNA3D.** Broadhouse, B.J. UKAEA Atomic Energy Establishment, Winfrith (UK). Safety and Engineering Science Div. Jul 1989. 15p. (CONF-8909370–: Workshop on DYNA3D, Trondheim (Norway), 7 Sep 1989). Source: Available from H.M. Stationery Office, London, price Pound 8.00.

Development of a constitutive material model for reinforced concrete in DYNA3D, and its validation against experiments for soft missile impacts on thin panels, have previously been reported to DYNA3D User Group meetings. Impacts on thick panels exhibit a more abrupt transition from the undamaged state to full perforation, and good results have been obtained for these cases. Many plant-generated missiles fall into the category of semi-hard impact, in which the contact stresses significantly exceed the compressive strength of the concrete. The material model has been developed and improved, so that the energy absorption due to crushing is properly accounted for, and model test results for this class of impact are simulated well in DYNA3D. (author).

53027 (AEEW-R–2449) **Fission product vapour - aerosol interactions in the containment: simulant fuel studies.** Beard, A.M.; Benson, C.G.; Bowsher, B.R. UKAEA Atomic Energy Establishment, Winfrith (UK). Chemistry Div. Dec 1988. 72p. Order Number DE91605980. Source: NTIS (US Sales Only), PC A04/MF A01; OSTI; INIS.

Experiments have been conducted in the Falcon facility to study the interaction of fission product vapours released from simulant fuel samples with control rod aerosols. The aerosols generated from both the control rod and fuel sample were chemically distinct and had different deposition characteristics. Extensive interaction was observed between the fission product vapours and the control rod aerosol. The two dominant mechanisms were condensation of the vapours onto the aerosol, and chemical reactions between the two components; sorption phenomena were believed to be only of secondary importance. The interaction of fission product vapours and reactor materials aerosols could have a major impact on the transport characteristics of the radioactive emission from a degrading core. (author).

53028 (AEEW-R–2470) **The interaction of simulant fission product vapours with control rod aerosols in a flowing system.** Beard, A.M.; Benson, C.G.; Bowsher, B.R. UKAEA Atomic Energy Establishment, Winfrith (UK). Chemistry Div. Dec 1988. 43p. Order Number DE91605981. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

Experiments have been undertaken to study the interaction of a variety of simulant fission products (caesium iodide, caesium hydroxide, tellurium and iodine) with aerosols generated from overheated Ag-In-Cd control rods in a flowing system. Two main interaction mechanisms have been identified: condensation of the vapour species onto the aerosol, and chemical reactions; sorption phenomena are believed to be of only secondary importance. This work has demonstrated the importance of physicochemical reactions between fission product vapours and reactor materials aerosols in defining the source term released from a severe reactor accident. (author).

53029 (AEEW-R–2472) **Fission product vapour - aerosol interactions in the containment: trace-irradiated fuel studies.** Beard, A.M.; Benson, C.G. UKAEA Atomic Energy Establishment, Winfrith (UK). Chemistry Div. Mar 1989. 41p. Order Number DE91605982. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

Experiments have been carried out in the Falcon facility to study the interaction of control rod aerosols with fission products released from trace-irradiated fuel. The release of the more volatile fission products depended on the temperature of the sample, and the deposition characteristics were determined by the presence of control rod aerosol. The interaction of fission product vapours and reactor materials aerosols could have a major effect on the transport and deposition of fission products in a severe reactor accident. This study has provided data which will ultimately allow mechanistic calculations to be tested, developed and subsequently applied to determine the consequences of a PWR severe accident with greater confidence. (author).

53030 (AEEW-R–2499) **Nodalisation of the Marviken pressuriser and inter-volume gravitational settling.** Williams, D.A.

UKAEA Atomic Energy Establishment, Winfrith (UK). Safety and Engineering Science Div. Apr 1989. 30p. Order Number DE91605984. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

A long-standing issue in the calculation of aerosol transport phenomena is the treatment of gravitational sedimentation in volumes which have no real settling surfaces. The VICTORIA primary circuit computer code has been extended to model inter-volume settling, and has been used to evaluate the importance of this mechanism for Marviken test 2b. The main conclusion of this study is that the neglect of inter-volume settling may result in the distortion of predicted deposition profiles and aerosol size distributions under certain conditions. These errors in the predicted aerosol behaviour may then give rise to further complications downstream. The results of the VICTORIA calculations are in good agreement with the data from test 2b. (author).

53031 (CNIC–00272) **A nuclear standard high-efficiency adsorber for iodine.** Wang Jianmin (Shanghai Nuclear Engineering Research and Development Inst., SH (China)); Qian Yinge. China Nuclear Information Centre, Beijing, BJ (China). Aug 1988. 8p. (In Chinese). (NERDI–0009). Order Number DE91605985. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

The structure of a nuclear standard high-efficiency adsorber, adsorbent and its performance are introduced. The performance and structure were compared with the same kind product of other firms. The results show that the leakage rate is less than 0.005%.

53032 (EUR–12393) **Deterministic and probabilistic crack growth analysis for the JRC Ispra 1/5 scale pressure vessel n^0 R2.** Bruckner-Foit, A. (Kernforschungszentrum Karlsruhe G.m.b.H (DE). Institut fuer Material-und Festkoerperforschung); Munz, D. Commission of the European Communities, Luxembourg (Luxembourg). Oct 1989. 21p. Contract No. 2958-86-06 ELISPD. Source: NTIS (US Sales Only), PC A03/MF A01.

A deterministic and a probabilistic crack growth analysis is presented for the major defects found in the welds during ultrasonic pre-service inspection. The deterministic analysis includes first a determination of the number of load cycles until crack initiation, then a cycle-by-cycle calculation of the growth of the embedded elliptical cracks, followed by an evaluation of the growth of the semi-elliptical surface crack formed after the crack considered has broken through the wall and, finally, a determination of the critical crack size and shape. In the probabilistic analysis, a Monte-Carlo simulation is performed with a sample of cracks where the statistical distributions of the crack dimensions describe the uncertainty in sizing of the ultrasonic inspection. The distributions of crack depth, crack length and location are evaluated as a function of the number of load cycles. In the simulation, the fracture mechanics model of the deterministic analysis is employed for each random crack. The results of the deterministic and probabilistic crack growth analysis are compared with the results of the second in-service inspection where stable extension of some of the cracks had been observed. It is found that the prediction and the experiment agree only with a probability of the order of 5% or less.

53033 (EUR–12394) **Review of constructive models for concrete.** Xiaoping, Y. (Technical Univ. of Denmark, Lyngby (DK)); Ottosen, N.S.; Thelandersson, S.; Nielsen, M.P. Commission of the European Communities, Luxembourg (Luxembourg). Nov 1989. 328p. Contract No. 3301-87-12 ELISPDK. Source: NTIS (US Sales Only), PC A15/MF A01.

This report has been prepared for the Commission of the European Communities, Joint Research Centre, ISPRA. The report reviews the constitutive models for concrete and is a part of a survey of the status of the analytical capabilities for predicting the structural response of NPP concrete containment buildings to severe loading conditions.

53034 (EUR–12395) **Analytical capability for predicting structural response of NPP concrete containments to severe loads.** Planas, J. (Universidad Politecnica de Madrid (ES). Escuela Technica Superior de Ingenieros Industriales); Guinea, G.; Trbojevic, V.M.; Marti, J.; Martinez, F.; Cortes, P. Commission of the European Communities, Luxembourg (Luxembourg). Dec 1989. 243p. Contract No. 3311-87-12 ELISPE. Source: NTIS (US Sales Only), PC A11/MF A01.

A survey has been conducted on the state-of-the-art of analytical techniques for predicting the structural response of concrete containment buildings under severe accident conditions. The validity of inelastic analysis is often limited by the inadequacy of the material models adopted. This is specially true in the case of materials which undergo localization phenomena in the course of the deformation process. Because of this, the Joint Research Centre at Ispra has given a high priority to the review of existing constitutive models for concrete. Such models must be able to describe concrete behaviour with and without steel reinforcement across the complete stress range, from initial elastic behaviour to and beyond the point of failure. For reinforced and prestressed concrete, segregated models (where concrete and steel are independently simulated) are preferred. A review of existing constitutive models for mass concrete has been conducted. The review focused on necessary features for describing the near-peak and post-peak stages of deformation. Special attention was dedicated to the localization of strains in tension and the post-peak softening behaviour. Existing models for representing the concrete steel bond were also reviewed. These models are still relatively simplistic and incorporate seldom a number of effects of considerable importance: sustained, dynamic and cyclic loading, environmental effects, etc. Finally, the computational procedures currently available for modelling problems involving the ultimate capacity of concrete containments have also been reviewed. This includes methodologies for modelling amongst other mass concrete, cracking procedures, bond behaviour, in existing computer codes.

53035 (HSE-Trans–13594A) **The nuclear safety charter.** Health and Safety Executive, London (UK); Ministere de l'Industrie et de la Recherche, 75 - Paris (France). Service Central de Surete des Installations Nucleaires. Dec 1989. 6p. Translation of La Charte de la Surete Nucleaire, December 1988. Source: Available from The British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

Translation of La Charte de la Surete Nucleaire, December 1988.

Declaration of the objectives and role of the Service Central de Surete des Installations Nucleaires. SCSIM is responsible for drawing up and enforcing Safety regulations, information to the public relating to nuclear installations and increasing safety standards in the Nuclear Industry. Resources include 500 people working on various projects and 500 engaged on annual site inspections. (UK).

53036 (IAEA-TECDOC–551, pp. 133-148) **Effect of oxygen in the simulated LOCA environments of the degradation of cable insulating materials.** Kusuma, Y. (Japan Atomic Energy Research Inst., Takasaki, Gunma (Japan). Takasaki Radiation Chemistry Research Establishment); Okada, S.; Itoh, M.; Yagi, T.; Yoshikawa, M.; Yoshida, K.; Machi, S.; Tamura, N.; Kawakami, W. International Atomic Energy Agency, Vienna (Austria). Apr 1990. (CONF-8907223–: Final research co-ordination meeting on radiation damage to organic materials in nuclear reactors and radiation environments, Takasaki (Japan), 17-20 Jul 1989). In *Radiation damage to organic materials in nuclear reactors and radiation environments: Proceedings of a final research co-ordination meeting, held in Takasaki, Japan, 17-20 July 1989.* 163p. Order Number DE91605608. Source: NTIS (US Sales Only), PC A08/MF A01; OSTI; INIS.

Five kinds of insulating and jacketing materials for the cables used in nuclear power plants were exposed to various LOCA environments of both simultaneous and sequential methods using SEAMATE-II. Experimental conditions of the simultaneous LOCA tests were done at different radiation dose rate, steam temperature and amount of air added to the LOCA environments. The sequential tests consist of two stages, that is, pre-irradiation and subsequent steam/spray exposure. Pre-irradiation conditions and subsequent steam/spray exposure conditions of the sequential LOCA tests are systematically changed in order to find appropriate conditions which can bring about the degradation of same degree to those obtained for various simultaneous LOCA simulations. Tensile properties, insulating resistance and water sorption of the

insulating materials exposed to various LOCA environments are measured and discussed. (author). 11 refs, 19 figs, 3 tabs.

53037 (RFP–4965) **Investigation of black spots and other blemishes inside small stainless steel pressure vessels.** Heiple, C.R.; Doyle, J.H.; Burgardt, P. EG and G Rocky Flats, Inc., Golden, CO (USA). Rocky Flats Plant. 14 Aug 1990. 24p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC34-90DP62349. Order Number DE91000509. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Black spots and other blemishes were found on the inside surface of small stainless steel pressure vessels by borescope inspection. Most of the black spots originated from pyrolysis of lint contaminating the interior surface of these parts prior to welding. The lint originated from cotton gloves used to handle parts and from cotton gauze used to clean the parts. Pyrolysis of other hydrocarbons can also create black spots. 34 figs.

2203 Fuel Elements

Refer also to citation(s) 53256, 53381, 54170

53038 (CDTN–ASPC.CN-001/89, pp. 48-104) **Annual report of the integrated program CDTN - FEC Nuclen in nuclear fuel area.** Pinheiro, R.B. Centro de Desenvolvimento da Tecnologia Nuclear (CDTN), Belo Horizonte, MG (Brazil). 1989. (In Portuguese). In *Semi-annual report of Nuclear Technology and Development Center (CDTN) - July to December 1988.* 353p. Order Number DE91606188. Source: NTIS (US Sales Only), PC A16/MF A01; OSTI; INIS.

The most important results of the integrated program CDTN-FEC Nuclen in the nuclear fuel are presented. (E.G.).

53039 (CNIC–00208) **Development test of multiple die with hydraulic compensation and auto lubrication.** Chen Mengyou (Ministry of Nuclear Industry, Zhengzhou, HN (China). Fifth Research and Design Inst.); Zhang Xichang; Zhu Ninghua; Liu Zichang. China Nuclear Information Centre, Beijing, BJ (China). May 1988. 8p. (In Chinese). (FRDIN–0002). Order Number DE91606000. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

Multiple die with hydraulic compensating device adopts the design of multidies gathering in a common grease cavity, using high temperature lubricating grease as the pressure compensating medium. According to Pascal's Law, each die will receive equal pressure during the process of pressing. Such device changes the equi-volume pressing mode of single mechanical die to equipressure pressing mode of multiple die in nuclear fuel element production, thus improves the quality and raises the quantity of nuclear fuel and powder ceramic products, giving a better economic benefit.

2204 Control Systems

Refer also to citation(s) 53572

53040 (JINR-E–10-90-323) **Clustering methods and visualization algorithms to aid nuclear reactor operative diagnostics.** Pepyolyshev, Y.N. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics); Dzwinel, W. Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics. [1990]. 21p. Sponsored by Joint Institute for Nuclear Research. (CONF-900710–1: Balancing automation and human action in nuclear power plants, Munich (Germany, F.R.), 9-13 Jul 1990). Order Number DE91001200. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; JINR, Publishing Department, Head Post Office, P.O. Box 79 101000 Moscow, USSR.

Noise and vibration analysis appears to be a valuable tool for non-destructive nuclear reactor condition monitoring. It enables early fault detection and gives the opportunity to avoid abnormal operation and accidental situations. To make the efficient and convenient tool for an operator the software system should enable the proper signal processing speed, its handling must be as easy as possible and the maximum information should be monitoring in the form of comprehensive patterns, relatively simple to analyze to perform suitable action. Pattern recognition techniques for noise analysis gives such an opportunity. The pioneering proposition of clustering application for a reactor control are presented in [3,4] and still have been used and developed (e.g. [5,6]). The reliability of such an approach depends mainly on the proper choice of clustering algorithm. In this paper some of pattern recognition methods for reactor operative diagnostics are recommended and the software system based on them is presented. In the last but not the least chapter, the information obtained by an operator is exemplified. The conclusions are reported at the end of the paper.

53041 (WHC-SA–0976) **Liquid metal reactor absorber technology.** Pitner, A.L. Westinghouse Hanford Co., Richland, WA (USA). Oct 1990. 15p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC06-87RL10930. (CONF-901101–36: American Nuclear Society winter meeting, Washington, DC (USA), 11-15 Nov 1990). Order Number DE91001177. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The selection of boron carbide as the reference liquid metal reactor absorber material is supported by results presented for irradiation performance, reactivity worth compatibility, and benign failure consequences. Scram response requirements are met easily with current control rod configurations. The trend in absorber design development is toward larger sized pins with fewer pins per bundle, providing economic savings and improved hydraulic characteristics. Very long-life absorber designs appear to be attainable with the application of vented pin and sodium-bonded concepts. 3 refs., 3 figs.

53042 **A computerized diagnostic system for nuclear plant control rooms based on statistical quality control.** Heising, C.D. (Northeastern Univ., Industrial Dept., Boston, MA (US)); Grenzebach, W.S. *Nuclear Technology (USA)*, 90(1): 7-15 (Apr 1990).

In engineering science, statistical quality control techniques have traditionally been applied to control manufacturing processes. An application to commercial nuclear power plant maintenance and control is presented that can greatly improve safety. As a demonstration of such an approach to plant maintenance and control, a specific system is analyzed: the reactor coolant pumps of the St. Lucie Unit 2 nuclear power plant located in Florida. A 30-day history of the four pumps prior to a plant shutdown caused by pump failure and a related fire within the containment was analyzed. Statistical quality control charts of recorded variables were constructed for each pump, which were shown to go out of statistical control many days before the plant trip. The analysis shows that statistical process control methods can be applied as an early warning system capable of identifying significant equipment problems well in advance of traditional control room alarm indicators.

2205 Environmental Aspects

Refer also to citation(s) 52818, 52838, 53788, 53814, 54173, 54179

53043 (CDTN–ASPC.CN-001/89, pp. 173-206) **Semi-annual report of the environmental engineer program of CDTN - July to December 1988.** Aun, P.E. Centro de Desenvolvimento da Tecnologia Nuclear (CDTN), Belo Horizonte, MG (Brazil). 1989. (In Portuguese). In *Semi-annual report of Nuclear Technology and Development Center (CDTN) - July to December 1988.* 353p. Order Number DE91606188. Source: NTIS (US Sales Only), PC A16/MF A01; OSTI; INIS.

This report is presented in three parts: the first is about the effects caused to the division by the small budget, the second explains the researches developed using nuclear techniques and the third describes the environmental control activities. (E.G.).

2206 Research, Test, and Experimental Reactors

Refer also to citation(s) 52838, 52983, 53019, 53020, 53021, 53081, 53083, 53579, 54388

53044 (AD-A–223876/4/XAB) **Recent re-measurement of the neutron and gamma-ray fields at large distances from a prompt critical facility.** Cousins, T.; Hoffarth, B.E.; Ing, H.; Tremblay, K. Defence Research Establishment, Ottawa, ON (Canada). Apr 1990. 42p. (DREO–1031). Source: NTIS, PC A03/MF A01.

Abstract in English and French.

Over the past few years the neutron (and to a lesser extent gamma-ray) energy spectra at the NATO standard reference point (400m from the core) at the Aberdeen Pulsed Radiation Facility, Aberdeen Proving Ground, MD, US has been the subject of experimental and theoretical controversy. This report describes the Canadian results of a joint NATO spectroscopic and dosimetric program carried out to end the controversy. Free-field and in-vehicle spectra are given, along with free-field and phantom dosimetric results. As a result of this work, several benchmark results have now been obtained, and specific recommendations for future research are given.

53045 (CDTN–ASPC.CN-001/89, pp. 248-256) **Semi-annual report of the CDTN reactor division - July to December 1988.** Carvalho Paiano, M. de. Centro de Desenvolvimento da Tecnologia Nuclear (CDTN), Belo Horizonte, MG (Brazil). 1989. (In Portuguese). In *Semi-annual report of Nuclear Technology and Development Center (CDTN) - July to December 1988.* 353p. Order Number DE91606188. Source: NTIS (US Sales Only), PC A16/MF A01; OSTI; INIS.

The support activities, development and training done by the Reactor division during the second semester of 1988 are described. (E.G.).

53046 (EUR–12396) **Development of advanced instrumentation for the Phebus FP project-preliminary studies.** Hampel, G. (Battelle - Institut e V. Frankfurt am Main (DE)); Poss, G. Commission of the European Communities, Luxembourg (Luxembourg). Oct 1989. 139p. Contract No. 3341-87-12 ELISPD. Source: NTIS (US Sales Only), PC A07/MF A01.

The objective of the project was to examine advanced measuring methods for on-line determination of aerosol, thermohydraulic and hydrogen parameters for their usefulness in the French core melting programme PHEBUS FP. Advanced methods that are known from reactor safety programmes as well as novel measuring techniques as used in related fields such as fuel reprocessing and in non-nuclear process technology have been described and analysed with a view to their potential application in the planned tests. Possibly necessary further developments and modifications have been identified and approaches to solution have been outlined. Special emphasis has been put on the present state of radiation resistant optical fibre wave-guides, which might be integrated in several instruments. As regards the particularly important on-line aerosol measurements in PHEBUS FP, a combined system is recommended as the most promising further development. This novel system configuration comprises the mass monitor of a MESA dust monitoring system and one or several photometers of EIR design.

53047 (MIC–90-04394/XAB) **Effect of high-frequency ground motion on the Maple-X10 reactor. Research report No. INFO-0335.** Bhan, S.; Dunbar, S. Atomic Energy Control Board, Ottawa, ON (Canada). ©1989. 62p. Source: NTIS, PC EE07/MF E01.

Atomic Energy of Canada Ltd. is planning to build the Maple-X10 research reactor at Chalk River, Ontario. The seismic design of the reactor is based on CSA Standard CAN3-N298.3-M81. The design response spectrum in the CSA standard is based on accelerogram records from western North America. However, recent observations suggest that accelerograms in eastern North America exhibit significantly higher frequencies than those in western North America. This report examines the effect of high-frequency ground motion on structures and equipment in nuclear reactors by subjecting simple linear models to selected recorded ground motions which exhibit low and high frequencies. Recommendations for a program of further research are given.

53048 **The advanced neutron source.** Hayter, J.B. (Solid State Division, Oak Ridge National Lab., Oak Ridge, TN (US)). pp. 27-40 of Neutron scattering for materials science. Materials Research Society proceedings: Volume 166. Shapiro, S.M.; Moss, S.C.; Jorgensen, J.D. Materials Research Society, Pittsburgh, PA (USA) (1990). pp. 499 (CONF-891119–: Materials Research Society fall meeting, Boston, MA (USA), 27 Nov - 2 dec 1989).

This paper reports on the Advanced Neutron Source (ANS), a new user experimental facility planned to be operational at Oak Ridge in the late 1990's. The centerpiece of the ANS will be a steady-state research reactor of unprecedented thermal neutron flux ($\phi_{th} \approx \cdot 10^{19}$ $m^{-2} \cdot s^{-1}$) accompanied by extensive and comprehensive equipment and facilities for neutron-based research.

2207 Plutonium and Isotope Production Reactors

Refer also to citation(s) 52818, 52819, 53234

53049 (CONF-9010217–1) **Effects of irradiation on initiation and crack-arrest toughness of two high-copper welds and on stainless steel cladding.** Nanstad, R.K.; Iskander, S.K.; Haggag, F.M. Oak Ridge National Lab., TN (USA). [1990]. 19p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC05-84OR21400. From 16. MPA seminar; Stuttgart (Germany, F.R.); 4-5 Oct 1990. Order Number DE91001272. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The objective of the study on the high-copper welds is to determine the effect of neutron irradiation on the shift and shape of the ASME K_{Ic} and K_{Ia} toughness curves. Two submerged-arc welds with copper contents of 0.23 and 0.31 wt % were commercially fabricated in 220-mm-thick plate. Compact specimens fabricated from these welds were irradiated at a nominal temperature of 288°C to fluences from 1.5 to 1.9 x 10^{19} neutrons/cm^2 (>1 MeV). The fracture toughness test results show that the irradiation-induced shifts at 100 MPa/m were greater than the Charpy 41-J shifts by about 11 and 18°C. Mean curve fits indicate mixed results regarding curve shape changes, but curves constructed as lower boundaries to the data do indicate curves of lower slopes. A preliminary evaluation of the crack-arrest results shows that the neutron-irradiation induced crack-arrest toughness temperature shift is about the same as the Charpy V-notch impact temperature shift at the 41-J energy level. The shape of the lower bound curves (for the range of test temperatures covered), compared to those of the ASME K_{Ia} curve did not appear to have been altered by the irradiation. Three-wire stainless steel weld overlay cladding was irradiated at 288°C to fluences of 2 and 5 x 10^{19} neutrons/cm^2 (>1 MeV). Charpy 41-J temperature shifts of 13 and 28°C were observed, respectively. For the lower fluence only, 12.7-mm thick compact specimens showed decreases in both J_{Ic} and the tearing modulus. Comparison of the fracture toughness results with typical plate and a low upper-shelf weld reveals that the irradiated stainless steel cladding possesses low ductile initiation fracture toughness comparable to the low upper-shelf weld. 8 refs., 12 figs., 2 tabs.

53050 (HW–66133-Del.) **High efficiency filter burning humidity tests for Project CGI-791 IPD Confinement Program.** Palmer, J.H. General Electric Co., Richland, WA (USA). Hanford Atomic Products Operation. [1959]. 83p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC06-76RL01830. Order Number DE91001398. Source: NTIS, PC A05/MF A01 - OSTI; GPO Dep.

Burning test were conducted on the three principal manufacturers' filters on the above dates. These tests were run chiefly to determine the fire resistive qualities of new adhesives used in binding the internals to the filter frames, and to test innovations adopted by two of the manufacturers. Moisture saturation tests are also being conducted, but as they are incomplete, will be covered by a separate report. These tests are being conducted in connection with the IPD confinement program and also at the request of AEC Safety and Fire Protection Engineers at Washington, DC, and at Hanford. The manufacturers, with our cooperation, are continuously endeavoring to improve the fire resistant qualities of their products. The change in adhesives and the innovations were made as a result of this endeavor. The tests were observed by representative of AEC Fire and Safety Engineers from Washington, DC, the Idaho Operations Office and the Hanford Operation. Members of IPD, HLO, CPD, and other HAPO Operations, and a representatives of the Purchasing Command, Army Chemical Corps, from Edgewood, Maryland, also witnessed the test. 33 figs.

53051 (HW–66995) **Tests to determine effect of humidity on high-efficiency filters when installed horizontally.** Palmer, J.H. General Electric Co., Richland, WA (USA). Hanford Atomic Products Operation. 4 Oct 1960. 5p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC06-76RL01830. Order Number DE91001399. Source: NTIS, PC A01/MF A01 - OSTI; GPO Dep.

The object of tests is to determine effect of high-humidity air on the physical characteristics of filter media and separators when the filter is mounted in the horizontal position. Usual installation is with the filter mounted vertically.

53052 (KURRI-TR-330, pp. 18-20) **Resent irradiation techniques in JMTR.** Kimura, A. (Tohoku Univ., Oarai, Ibaraki (Japan). Oarai Branch of Inst. for Meterials Research); Kayano, H. Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst. Mar 1990. (In Japanese). (CONF-8908245--: Workshop on development and application of low temperature irradiation and irradiation facilities; Workshop on development and application of low temperature irradiation and irradiation facilities, Kumatori (Japan); KUMATORI (is not a va In *Proceedings of the workshop on development and application of low temperature irradiation and irradiation facilities.* 145p. Order Number DE90513870. Source: NTIS (US Sales Only), PC A07/MF A01.

Published in summary form only. IRRADIATION CAPSULES/jmtr reactor; IRRADIATION DEVICES; IRRADIATION PROCEDURES; TEMPERATURE CONTROL

2209 Reactor Safety

Refer also to citation(s) 52961, 52991, 53014, 53042, 53050, 53051, 53234, 53395, 53408, 53409, 53814, 53839, 54391, 54438

53053 (AEEW-R-2474) **Fission product and aerosol behaviour within the containment: Summary report.** Beard, A.M.; Benson, C.G.; Bowsher, B.R.; Dickinson, S.; Nichols, A.L. UKAEA Atomic Energy Establishment, Winfrith (UK). Chemistry Div. Jan 1989. 45p. Contract 3017-86-08 EL ISP GB. Order Number DE91605983. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

Experimental studies have been undertaken to characterise the behaviour of fission products in the containment of a pressurised water reactor during a severe accident. The following aspects of fission product transport have been studied: (a) aerosol nucleation, (b) vapour transport processes, (c) chemical forms of high-temperature vapours, (d) interaction of fission product vapours with aerosols generated from within the reactor core, (e) resuspension processes, (f) chemistry in the containment. (author).

53054 (CONF-9009273--1) **Overview of the Integrated Pressurized Thermal-Shock (IPTS) study.** Cheverton, R.D. Oak Ridge National Lab., TN (USA). [1990]. 23p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC05-84OR21400. From U.S./Japanese specialized topic workshop on pressurized thermal shock; Rockville, MD (USA); 26-28 Sep 1990. Order Number DE91000733. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

By the early 1980s, (PTS)-related, deterministic, vessel-integrity studies sponsored by the US Nuclear Regulatory Commission (NRC) indicated a potential for failure of some PWR vessels before design end of life, in the event of a postulated severe PTS transient. In response, the NRC established screening criteria, in the form of limiting values of the reference nil-ductility transition temperature (RT_{NDT}), and initiated the development of a probabilistic methodology for evaluating vessel integrity. This latter effort, referred to as the Integrated Pressurized Thermal-Shock (IPTS) Program, included development of techniques for postulating PTS transients, estimating their frequencies, and calculating the probability of vessel failure for a specific transient. Summing the products of frequency of transient and conditional probability of failure for each of the many postulated transients provide a calculated value of the frequency of failure. The IPTS Program also included the application of the IPTS methodology to three US PWR plants (Oconee-1, Calvert Cliffs-1, and HBRobinson-2) and the specification of a maximum permissible value of the calculated frequency of vessel failure. Another important purpose of the IPTS study was to determine, through application of the IPTS methodology, which design and operating features, parameters, and PTS transients were dominant in affecting the calculated frequency of failure. The scope of the IPTS Program included the development of a probabilistic fracture-mechanics capability, modification of the TRAC and RELAP5 thermal/hydraulic codes, and development of the methodology for estimating the uncertainty in the calculated frequency of vessel failure.

53055 (CONF-9009273--2) **IPTS [Integrated Pressurized-Thermal-Shock] study for H.B. Robinson (HBR-HYPO).** Cheverton, R.D. Oak Ridge National Lab., TN (USA). [1990]. 44p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC05-84OR21400. From U.S./Japanese specialized topic workshop on pressurized thermal shock; Rockville, MD (USA); 26-28 Sep 1990. Order Number DE91000734. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

A primary purpose of the US Nuclear Regulatory Commission (NRC) Integrated Pressurized-Thermal-Shock (IPTS) Program, completed in 1985, was to develop an integrated probabilistic approach for evaluating pressurized water reactor (PWR) pressure vessel integrity; and the scope included the application of the methodology to three "high risk" PWR plants. The three plants selected were Oconee Unit 1, Calvert Cliffs Unit 1, and HBRobinson Unit 2 (HBR-2); and the plant studies were conducted in that order. As a result of this sequence and the developmental nature of the program, the HBR-2 study was the more complete and state-of-the-art. However, by the time the HBR-2 study was conducted, a reevaluation of vessel chemistry and reference nil-ductility transition temperature (RT_{NDT}) had indicated relatively low concentrations of copper and nickel and low values of initial $RT_{NDT}(RT_{NDT_0})$, resulting in very low probabilities of failure. Thus, for illustrative purposes, copper, nickel, and RT_{NDT_0} were increased so that $RT_{NDT}(2\sigma) = 270°F$ for the critical weld at 32 EFPY. This value of RT_{NDT} corresponds, of course, to the NRC PTS-Rule screening criteria (10 CFR 5.61). This hypothetical "plant" was referred to as HBR-HYPO, and it was identical to HBR-2 in every respect except for the concentrations of copper and nickel and the value of RT_{NDT_0} for the welds. 3 refs.

53056 (CONF-9010185--3) **Management of the aging of critical safety-related concrete structures in light-water reactor plants.** Naus, D.J. (Oak Ridge National Lab., TN (USA)); Oland, C.B.; Arndt, E.G. Oak Ridge National Lab., TN (USA). [1990]. 67p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC05-84OR21400. From 18. water reactor safety information meeting; Gaithersburg, MD (USA); 22-24 Oct 1990. Order Number DE91001632. Source: NTIS, PC A04/MF A01; OSTI; INIS; GPO Dep.

The Structural Aging Program has the overall objective of providing the USNRC with an improved basis for evaluating nuclear power plant safety-related structures for continued service. The program consists of a management task and three technical tasks: materials property data base, structural component assessment/repair technology, and quantitative methodology for continued-service determinations. Objectives, accomplishments, and planned activities under each of these tasks are presented. Major program accomplishments include development of a materials property data base for structural materials as well as an aging assessment methodology for concrete structures in nuclear power plants. Furthermore, a review and assessment of inservice inspection techniques for concrete materials and structures has been complete, and work on development of a methodology which can be used for performing current as well as reliability-based future condition assessment of concrete structures is well under way. 43 refs., 3 tabs.

53057 (CONF-9010185--4) **Heavy-Section Steel Technology program overview.** Pennell, W.E. Oak Ridge National Lab., TN (USA). [1990]. 33p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC05-84OR21400. From 18. water reactor safety information meeting; Gaithersburg, MD (USA); 22-24 Oct 1990. Order Number DE91001629. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

This paper presents a status review of ongoing HSST program tasks aimed at refining the technology used in analysis of reactor pressure vessel fracture margins under pressurized thermal-shock (PTS) loading. Specific fracture-technology issues addressed include vessel flaw density and distribution, shallow flaws, fracture-toughness data transfer, circumferential cracks, ductile tearing and the influence of low-tearing toughness in stainless steel cladding.

Preliminary results from the analysis and test programs are presented, together with interim assessments of their potential impact on a reactor vessel PTS analysis. 31 refs., 23 figs., 1 tab.

53058 (EPRI-NP–6644-Rev.1) **Utility industry evaluation of the power reactor inherently safe module: Revision 1: Final report.** Burstein, S. (Wisconsin Electric Power Co., Milwaukee, WI (USA)); DelGeorge, L.O.; Tramm, T.R.; Gibbons, J.P.; High, M.D.; Neils, G.H.; Pearson, O.F.; Tomonto, J.R.; Pilmer, D.F. Electric Power Research Inst., Palo Alto, CA (USA); Wisconsin Electric Power Co., Milwaukee, WI (USA); Commonwealth Edison Co., Chicago, IL (USA); Philadelphia Electric Co., PA (USA); Tennessee Valley Authority, Knoxville, TN (USA); Northern States Power Co., Minneapolis, MN (USA); Florida Power and Light Co., Miami, FL (USA); Southern California Edison Co., Rosemead, CA (USA); Pacific Gas and Electric Co., San Francisco, CA (USA). ©Sep 1990. 123p. Sponsored by Electric Power Research Institute. Source: Research Reports Center, Box 50940, Palo Alto, CA 94303.

A team of utility industry representatives evaluated the Power Reactor Inherently Safe Module plant design, a current liquid metal reactor design created by an industrial team led by General Electric under Department of Energy sponsorship. The utility industry team concluded that the plant design offers several attractive characteristics, especially in the safety arena, as well as perserving the traditional attraction of liquid metal reactors, very high fuel utilization. Specific comments and recommendations are provided as a contribution towards improving an already attractive plant design. 11 refs.

53059 (EPRI-NP–6931) **The cleanup of Three Mile Island Unit 2: A technical history, 1979–1990: Final report.** Holton, W.C. (Grove Engineering, Inc., Rockville, MD (USA)); Negin, C.A.; Owrutsky, S.L. Electric Power Research Inst., Palo Alto, CA (USA); Grove Engineering, Inc., Rockville, MD (USA). ©Sep 1990. 370p. Sponsored by Electric Power Research Institute. Source: Research Reports Center, Box 50490, Palo Alto, CA 94303.

The Electric Power Research Institute has sponsored a technical history project to ensure that the logic and consequences of decisions made during the Three Mile Island Unit 2 (TMI-2) cleanup are available for recovery from an accident involving damaged fuel and fission product release. The objectives of the history project are to identify the major questions and challenges facing management; describe the influencing factors and the options available; and present the final decisions and their consequences. This history of decision-making is intended to assist a project manager who must respond to a fuel damage accident, even if the scale is much smaller than TMI-2. The history has focused on decisions related to seven major aspects of the cleanup: cleanup management, postaccident stabilization, personnel protection, data acquisition, radioactive waste management, decontamination, and defueling. A detailed chronology and extensive bibliography accompany the text.

53060 (EPRI-NP–6978) **On-site radiation exposure in severe reactor accidents: Scoping study: Final report.** Warman, E.A. (Stone and Webster Engineering Corp., Boston, MA (USA)); Karahalios, P.; Celnick, J.; McInall, S.; Frank, S. Electric Power Research Inst., Palo Alto, CA (USA); Stone and Webster Engineering Corp., Boston, MA (USA). ©Sep 1990. 54p. Sponsored by Electric Power Research Institute. Source: Research Reports Center, Box 50490, Palo Alto, CA 94303.

The results of a scoping study of onsite radiation exposures which could take place in each of three types of postulated reactor accidents are presented. The accident types are (1) a fuel handling accident at a Mark III BWR; an interfacing system LOCA or V sequence at a PWR; and and Anticipated Transient Without Scram (ATWS) at a Mark I BWR. Both external and internal dose pathways are considered. The results of the study indicate the prohibitively high radiation doses could be received in some plant areas if personnel were to remain there. However, times of the order of a few minutes to a few hours, depending on the type of accident, would be available before life-threatening doses would be accumulated assuming that the provided full face respiratory protection equipment were used promptly. Special attention was given radiation doses possibly received by control room personnel for several control room air in-leakage assumptions. For occupancy during severe accidents it would be advisable for control room personnel to use self-contained apparatus (SCBA) to limit exposure via inhalation. The results of this study will be useful to individuals responsible for accident management procedures. It is indicated that it will be important for each plant to develop estimates of the time of onset of prohibitively high radiation levels in various important plant areas. It is concluded that respiratory protection is a major factor owing to the large inhalation doses which might otherwise be encountered. 20 refs., 8 figs., 6 tabs.

53061 (EUR–12269) **Radioactivity measurements in Europe after the Chernobyl accident. Part 1: Part I: Air.** Raes, F. (Commission of the European Communities, Ispra (Italy). Joint Research Centre); Graziani, G.; Grossi, L.; Marciano, L.; Peirs, D.; Pedersen, B.; Stanners, D.; Zarimpas, N. Commission of the European Communities, Luxembourg (Luxembourg). 1989. 249p. Source: NTIS (US Sales Only), PC A11/MF A01; OSTI; INIS.

The data base presented is being set up primarily for scientific studies such as the validation of long range transport models, physico-chemical behaviour of radionuclides in air, etc. The data were extracted from the REM Data Bank at the Joint Research Centre of the Commission of the European Communities at Ispra. The data where originally obtained from written reports or were copied directly from tapes or diskettes into the REM Data Bank. In the latter case, verification with written material was persued. The original sources are given in the references. In preparing this report, only those data were retained which were fully specified as far as time, location and measuring techniques are concerned, i.e.: beginning and end of sampling, geographical coordinates and types of filters are known.

53062 (EUR–12605) **Research into the melting/refining of contaminated steel scrap arising in the dismantling of nuclear installations.** Harvey, D.S. (British Steel Corp., Rotherham (UK). Swinden Labs.). Commission of the European Communities, Luxembourg (Luxembourg). 1990. 93p. contract No FI1D-0015. Source: NTIS (US Sales Only), PC A05/MF A01.

The main part of this report is concerned with the steel-making behaviour of various radioisotopes encountered in steel from decommissioning of nuclear installations (e.g. cobalt 60, caesium 134 and europium 154). Under a wide range of conditions cobalt is largely absorbed by the steel, europium is absorbed by the slag, whereas caesium may be largely volatized, or largely absorbed by the slag. Radiation exposures which might occur during a large-scale recycling operation, during routine operations and accidents would not be significant according to published criteria in the UK. The second part of the report concerns the detection of radioactive materials which may be accidentally delivered to steelworks in scrap steel and used in steel-making. Detectors have been developed which would indicate the presence of radioactivity in scrap. A survey of the steelworks revealed areas where detection might be performed. Experiments have shown that a gamma ray detector of large volume could provide useful sensitivity of detection.

53063 (IAEA-INFCIRC–335(Add.4)) **Convention on early notification of a nuclear accident. Convention on assistance in the case of a nuclear accident or radiological emergency: Reservations/Declarations as of 31 July 1990.** International Atomic Energy Agency, Vienna (Austria). Aug 1990. 37p. (IAEA-INFCIRC–336(Add.5)). Order Number DE91606180. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

The document refers to the Convention on Early Notification of a Nuclear Accident (IAEA-INFCIRC-335) and to the Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency (IAEA-INFCIRC-336). Part I contains reservations/declarations made upon or following signature and Part II contains reservations/declarations made upon or following deposit of instrument expressing consent to be bound. The status of signature, ratification, acceptance, approval or accession by States or organizations as of 31 July 1990 is presented in two attachments.

53064 (Juel-Conf–71, pp. 3-11) **Objective of the workshop on structural design criteria for HTR - survey of the research activities in the Federal Republic of Germany.** Nickel, H. (Kernforschungsanlage Juelich GmbH (Germany, F.R.). Inst. fuer

Reaktorwerkstoffe). Kernforschungsanlage Juelich GmbH (Germany, F.R.). Apr 1989. (CONF-890186--: Workshop on structural design criteria for HTR, Julich (Germany, F.R.), 31 Jan - 1 feb 1989). In *Proceedings of the workshop on structural design criteria for HTR.* 557p. Order Number DE91717019. Source: NTIS (US Sales Only), PC A24/MF A01.

Technical guidelines and design codes for nuclear plants in the Federal Republic of Germany are tailored to the light water reactor (LWR) systems, so that a design code for the helium-cooled high temperature reactor (HTR) has to be formulated. In an extensive research project, the underlying principles for such a design code have been worked out. The aim of the workshop is to present the current status of the work. (orig.).

53065 (Juel-Conf-71, pp. 83-96) **HTR safety features and the integrity concept.** Wolters, J. (Kernforschungsanlage Juelich GmbH (Germany, F.R.). Inst. fuer Nukleare Sicherheitsforschung). Kernforschungsanlage Juelich GmbH (Germany, F.R.). Apr 1989. (CONF-890186--: Workshop on structural design criteria for HTR, Julich (Germany, F.R.), 31 Jan - 1 feb 1989). In *Proceedings of the workshop on structural design criteria for HTR.* 557p. Order Number DE91717019. Source: NTIS (US Sales Only), PC A24/MF A01.

The accident behaviour of the HTR in the case of the structural failure of those components which serve for the safe enclosure of the radioactive substances within the plant is delineated. It is the basis for the formulation of the general requirements for the structural integrity of these components. The requirements together with the measures necessary to ensure an appropriate quality of the components form what is understood as the integrity concept. It is part of the HTR-specific safety concept. (orig./DG).

53066 (Juel-Conf-71, pp. 97-109) **Classification of systems and components into safety classes and quality standard classes.** Dette, M. (Rheinisch-Westfaelischer Technischer Ueberwachungs-Verein e.V., Essen (Germany, F.R.)). Kernforschungsanlage Juelich GmbH (Germany, F.R.). Apr 1989. (CONF-890186--: Workshop on structural design criteria for HTR, Julich (Germany, F.R.), 31 Jan - 1 feb 1989). In *Proceedings of the workshop on structural design criteria for HTR.* 557p. Order Number DE91717019. Source: NTIS (US Sales Only), PC A24/MF A01.

On the basis of a meaningful classification of the systems for the entire plant, every system or component is allocated a safety class. Every allocation is based on the performance of a safety analysis in which the radiological effects of a component failure for plant personnel and the environment are evaluated. The subdivision into five safety classes is therefore also based on the related limit values of the Radiation Protection Ordinance. The HTR-500 metallic pressure vessel closure with simple cover head was selected as an example for the procedure for such a classification. (DG).

53067 (Juel-Conf-71, pp. 444-463) **Design principles for MHTGR pressure vessels.** Hoffmann, C.L. (Combustion Engineering, Inc., Windsor, CT (USA)). Kernforschungsanlage Juelich GmbH (Germany, F.R.). Apr 1989. (CONF-890186--: Workshop on structural design criteria for HTR, Julich (Germany, F.R.), 31 Jan - 1 feb 1989). In *Proceedings of the workshop on structural design criteria for HTR.* 557p. Order Number DE91717019. Source: NTIS (US Sales Only), PC A24/MF A01.

In order to avoid using high temperature design rules and materials, an application specific ASME Code Case is being sought to allow limited exposure of the selected pressure vessel materials (SA 533 GrB, SA 508 Cl. 2+3) at temperatures above 370deg C (700deg F). An experimental materials test program is underway to support the approval of this Code Case. The test program is intended to characterize the time/temperature dependent behavior of the MHTGR pressure vessel materials. Prediction of the irradiation-induced shift in the nil-ductility transition temperature (NDTT) for the MHTGR reactor vessel is based upon an extensive data base and accepted methodology for LWR vessels. Since the MHTGR reactor vessel operates at temperatures somewhat below the range over which the LWR data base and methodology was developed, additional conservatism is applied to the shift predictions in the design. The calculated NDTT shifts will be verified by an experimental irradiation program during the design phase. In addition, a reactor pressure vessel surveillance program will monitor the change in material characteristics during the operating life of the reactor vessel. (orig./DG).

53068 (Juel-Conf-71, pp. 493-505) **Analysis of the graphite side reflector block of the HTR-module.** Rathjen, P. (Internationale Atomreaktorbau GmbH (INTERATOM), Bergisch Gladbach (Germany, F.R.)). Kernforschungsanlage Juelich GmbH (Germany, F.R.). Apr 1989. (CONF-890186--: Workshop on structural design criteria for HTR, Julich (Germany, F.R.), 31 Jan - 1 feb 1989). In *Proceedings of the workshop on structural design criteria for HTR.* 557p. Order Number DE91717019. Source: NTIS (US Sales Only), PC A24/MF A01.

The selected side reflector block contains an oblong hole which is located in the front part and separated from the pebble-bed core by a graphite ligament. This opening serves to take in the small absorber balls for long-term shutdown. The material considered in the stress assessment is reactor graphite ASR-IRS. The side reflector is subjected to stress-controlled loadings due to the pebble-bed mechanics and to strain-controlled loadings due to non-uniform distributions of temperature and of neutron irradiation. The analysis of deformations and stresses, taking into account the irradiation induced changes of properties and creep, has been carried out using a three-dimensional model of the finite element programme IAGUAR developed by Interatom. The analysis considers reactor operation and reactor shutdown as loading conditions. The results are presented in the form of time and section profiles of stresses and deformations. (orig./DG).

53069 (Juel-Conf-71, pp. 506-524) **Design criteria for graphite components of HTTR.** Iyoku, Tatsuo (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). HTTR Designing Lab.); Shiozawa, Shusaku; Arai, Taketoshi. Kernforschungsanlage Juelich GmbH (Germany, F.R.). Apr 1989. (CONF-890186--: Workshop on structural design criteria for HTR, Julich (Germany, F.R.), 31 Jan - 1 feb 1989). In *Proceedings of the workshop on structural design criteria for HTR.* 557p. Order Number DE91717019. Source: NTIS (US Sales Only), PC A24/MF A01.

The design criteria for the graphite core and core support components in the High Temperature Engineering Test Reactor have been developed by JAERI and will be authorized by the Japanese Government. The design criteria are mainly based on ASME sec. III, div. 2, subsection CE code (draft), however, the ASME CE code is partially modified in the items of bi-axes failure theory, buckling limit and oxidation effects on the basis of test data. This paper summarizes the design criteria developed by JAERI and details the limits different from the ASME CE code. A brief explanation is also made in this paper for quality control specified in the design criteria. (orig.).

53070 (LA--11661-MS-Vol.1) **Guidance for the preparation of safety analysis reports: Volume 1, Format and content.** Howard, H.H.; Faust, C.L.; Hoffman, L.G.; Graf, J.M. Los Alamos National Lab., NM (USA). Jun 1990. 51p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract W-7405-ENG-36. Order Number DE91000515. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This document provides guidance on the format and content for safety analysis reports. An overview of Department of Energy (DOE) Order 5481.1B, "Safety Analysis and Review System" and a discussion of the relationship between the safety analysis and review system and the National Environmental Policy Act are included. Objectives, required topics, and manuscript and editing styles of a safety analysis report are discussed.

53071 (MIC--90-04390/XAB) **Cold water injection into two-phase mixtures. Research report No. INFO-0337.** Atlantic Nuclear Services, Ottawa, ON (Canada). ©1989. 129p. Source: NTIS, PC EE12/MF E01.

Review and assessment of information on dynamic loadings caused by the injection of cold water into 2-phase mixtures in nuclear power plants. The review was conducted through a critical survey of the national and international literature of open technical reports concerning the dynamic consequences of cold water injections; documentation of the transients experienced and reported; definition of the thermalhydraulic conditions giving rise to severe dynamic load on equipment and bounds for the conditions initiating transients; description of the underlying physical processes of the

load transients; and a description of the response of equipment to the severe dynamic loads. This report presents the findings of the study.

53072 (MIC–90-04391/XAB) **Dispersion, mixing, and intentional ignition of hydrogen in the Darlington reactor vault. Research report No. INFO-0327.** Lee, J.H.S.; Knystautas, R. Atomic Energy Control Board, Ottawa, ON (Canada). ©1989. 57p. Source: NTIS, PC EE07/MF E01.

Review of the Darlington safety report (DSR) which has been used as a basis for decisions regarding intentional ignition in the Darlington reactor vault. The review includes an assessment of the validity of the assumptions in the DSR regarding mixing of contents; examines possible hydrogen release scenarios, specific to the Darlington reactor vault; reviews the combustion analysis in the DSR vent code calculations in the light of existing state-of-the-art information on high speed turbulent flames and transition to detonation; and identifies limitations of the vent code in this context. Improvements are recommended.

53073 (MIC–90-04756/XAB) **Nuclear emergency plan, Part III: Bruce.** Government of Ontario, Toronto, ON (Canada). ©1989. 75p. Source: NTIS, PC EE07/MF E01.

The Province of Ontario nuclear emergency plan parts I through VIII were developed pursuant to Section 8 of the Emergency Plans Act, 1983. This part III prescribes measures to be taken to deal with a nuclear emergency caused by the Bruce Nuclear Power Development. This plan deals mainly with actions at the provincial level and should be supplemented by the appropriate municipal plan from the Townships of Bruce and Kincardine and the Village of Tiverton. This document gives details on the plan data and organization and measures to be taken for internal and external notification, operations in general and for liquid emissions, and the provision of emergency information and public direction. Appendices detail response sector boundaries, alerting and lead times, outline plan and times for evacuation, the location of emergency facilities, and communications through television, radio and telephone.

53074 (NEAG–1TP4B-90009-(Vol.2)) **SPES experimental program: OECD/CSNI ISP22 draft comparison report: Volume 2, Chapter 4 (4.1 to 4.9).** De Toma, G.; Ederli, S.; Negrenti, E.; Marsili, P.; Pignatelli, T. ENEA, Casaccia (Italy). Dipt. Reattori Termici. Mar 1990. 369p. Order Number DE90706234. Source: NTIS (US Sales Only), PC A16/MF A01.

OECD-CSNI International Standard Problem 22 is a "Loss of Feedwater with EFW delayed" test, performed in the SPES facility (SIET-Piacenza). It is a double blind exercise, characterized by a large participation of non-OECD countries sponsored by IAEA. The Draft Comparison Report is based on two fundamental elements: the comparison between the single Participants predictions and the experimental data, and the overall comparison among all calculations and test results. The conclusions drawn from these analyses highlight the major contributes to the observed discrepancies deriving from code limitations, user errors, experimental uncertainties. From a macroscopic point of view, it is concluded that most of the phenomena occurring in ISP22 experiment were generally predicated by the double blind predictions. A more accurate analysis of the single phenomena can nevertheless reveal relevant discrepancies between calculations and data. The document also contains a description of ISP22 Participants and input decks, and a collection of their comments on the differences between calculation and test results. This document, Volume 2, provides comparison criteria of Chapter 4, Parts 4.1 thru 4.9.

53075 (NEAG–1TP4B-90009-(Vol.3)) **SPES experimental program: OECD/CSNI ISP22 draft comparison report: Volume 3, Chapter 4 (4.10 to 4.18).** De Toma, G.; Ederli, S.; Negrenti, E.; Marsili, P.; Pignatelli, T. ENEA, Casaccia (Italy). Dipt. Reattori Termici. Mar 1990. 401p. Order Number DE90706235. Source: NTIS (US Sales Only), PC A18/MF A01.

OECD-CSNI International Standard Problem 22 is a "Loss of Feedwater with EFW delayed" test, performed in the SPES facility (SIET-Piacenza). It is a double blind exercise, characterized by a large participation of non-OECD countries sponsored by IAEA. The Draft Comparison Report is based on two fundamental elements: the comparison between the single Participants predictions and the experimental data, and the overall comparison among all calculations and test results. The conclusions drawn from these analyses highlight the major contributes to the observed discrepancies deriving from code limitations, user errors, experimental uncertainties. From a macroscopic point of view, it is concluded that most of the phenomena occurring in ISP22 experiment were generally predicted by the double blind predictions. A more accurate analysis of the single phenomena can nevertheless reveal relevant discrepancies between calculations and data. The document also contains a description of ISP22 Participants and input decks, and a collection of their comments on the differences between calculation and test results. This document, Volume 3, provides comparison criteria of Chapter 4, Parts 4.10 thru 4.18.

53076 (NEAG–1TP4B-90009-(Vol.4)) **SPES experimental program: OECD/CSNI ISP22 draft comparison report: Volume 4, Chapters 5 to 8.** De Toma, G.; Ederli, S.; Negrenti, E.; Marsili, P.; Pignatelli, T. ENEA, Casaccia (Italy). Dipt. Reattori Termici. Mar 1990. 229p. Order Number DE90706236. Source: NTIS (US Sales Only), PC A11/MF A01.

OECD-CSNI International Standard Problem 22 is a "Loss of Feedwater with EFW delayed" test, performed in the SPAS facility (SIET-Piacenza). It is a double blind exercise, characterized by a large participation on non-OECD countries sponsored by IAEA. The Draft Comparison Report is based on two fundamental elements: the comparison between the single Participants predictions and the experimental data, and the overall comparison among all calculations and test results. The conclusions drawn from these analyses highlight the major contributes to the observed discrepancies deriving from code limitation, user errors, experimental uncertainties. From a macroscopic point of view, it is concluded that most of the phenomena occurring in ISP22 experiment were generally predicted by the double blind predictions. A more accurate analysis of the single phenomena can nevertheless reveal relevant discrepancies between calculations and data. The document also contains a description of ISP22 Participants and input decks, and a collection of their comments on the differences between calculation and test results. This document, Volume 4, provides Chapters 5 thru 8 which are: overall comparisons; participants; comments; conclusions; and references respectively.

53077 (NUREG–1403) **Safety Evaluation Report related to the full-term operating license for Dresden Nuclear Power Station, Unit 2 (Docket No. 50-237).** Nuclear Regulatory Commission, Washington, DC (USA). Div. of Reactor Projects III, IV, V and Special Projects. Oct 1990. 35p. Sponsored by Nuclear Regulatory Commission. Source: NTIS, PC A03/MF A01 - GPO; OSTI; INIS.

The Safety Evaluation Report for the full-term operating license application filed by Commonwealth Edison Company for the Dresden Nuclear Power Station, Unit 2, has been prepared by the Office of Nuclear Regulation of the US Nuclear Regulatory Commission. The facility is located in Grundy County, Illinois. Subject to favorable resolution of the items discussed in this report, the staff concludes that the facility can continue to be operated without endangering the health and safety of the public. 72 refs.

53078 (NUREG–1417) **Safety Evaluation Report related to Hydrogen Control Owners Group assessment of Mark 3 containments.** Li, C.Y.; Kudrick, J.A. Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Reactor Regulation. Oct 1990. 38p. Sponsored by Nuclear Regulatory Commission. Source: NTIS, PC A03/MF A01 - GPO - OSTI.

Title 10 of the Code of Federal Regulations (10 CFR), Section 50.44 "Standards for Combustible Gas Control System in Light-Water-Cooled Power Reactors," requires that systems be provided to control hydrogen concentration in the containment atmosphere following an accident to ensure that containment integrity is maintained. The purpose of this report is to provide regulatory guidance to licensees with Mark III containments with regard to demonstrating compliance with 10 CFR 50.44, Section (c)(3)(vi) and (c)(3)(vii). In this report, the staff provides its evaluation of the generic methodology proposed by the Hydrogen Control Owners Group. This generic methodology is documented in Topical Report HGN-112-NP, "Generic Hydrogen Control Information for BWR/6 Mark III Containments." In addition, the staff has recommended that the

vulnerability to interruption of power to the hydrogen igniters be evaluated further on a plant-specific basis as part of the individual plant examination of the plants with Mark III containments. 10 figs., 1 tab.

53079 (NUREG/CP–0113) **Transactions of the eighteenth water reactor safety information meeting.** Weiss, A.J. (comp.). Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Regulatory Research. Oct 1990. 211p. Sponsored by Nuclear Regulatory Commission. Source: NTIS, PC A10/MF A01 - GPO; OSTI; INS.

This report contains summaries of papers on reactor safety research to be presented at the 18th Water Reactor Safety Information Meeting at the Holiday Inn Crowne Plaza in Rockville, Maryland, October 22–24, 1990. The summaries briefly describe the programs and results of nuclear safety research sponsored by the Office of Nuclear Regulatory Research, USNRC. Summaries of invited papers concerning nuclear safety issues from the electric utilities, the Electric Power Research Institute (EPRI), the nuclear industry, and from the governments and industry in Europe and Japan are also included. The summaries have been compiled in one report to provide a basis for meaningful discussion and information exchange during the course of the meeting, and are given in the order of their presentation in each session. Each individual paper has been cataloged separately.

53080 (NUREG/CR–5507) **Results from the Nuclear Plant Aging Research Program: Their use in inspection activities.** Gunther, W. (Brookhaven National Lab., Upton, NY (USA)); Taylor, J. Nuclear Regulatory Commission, Washington, DC (USA). Div. of Engineering; Brookhaven National Lab., Upton, NY (USA). Sep 1990. 78p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC02-76CH00016. (BNL-NUREG–52222). Source: NTIS, PC A05/MF A01 - GPO; OSTI; INIS.

The US NCR's Nuclear Plant Aging Research (NPAR) Program has determined the susceptibility to aging of components and systems, and the potential for aging to impact plant safety and availability. The NPAR Program also identified methods for detecting and mitigating aging in components. This report describes the NPAR results which can enhance NRC inspection activities. Recommendations are provided for communicating pertinent information to NRC inspectors. These recommendations are based on a detailed assessment of the NRC's Inspection Program, and feedback from resident and regional inspectors as described within. Examples of NPAR report summaries and aging inspection guides for components and systems are included. 13 refs., 3 figs., 4 tabs.

53081 (ORNL/TM–11324) **Steam-explosion safety considerations for the Advanced Neutron Source Reactor at the Oak Ridge National Laboratory.** Taleyarkhan, R. Oak Ridge National Lab., TN (USA). Feb 1990. 66p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE91001002. Source: NTIS, PC A05/MF A01 - OSTI; GPO Dep.

This report provides a perspective on steam-explosion safety and design issues for the Advanced Neutron Source (ANS) reactor being designed at the Oak Ridge National Laboratory. A historical background along with a description of experiments and analytical work performed to date has been provided. Preliminary analyses (for the ANS) have been conducted to evaluate steam-explosion pressure- pulse loadings, the effects of reactor coolant system (RCS) overpressurization, and slug energetics. The method used for pressure-pulse magnitude evaluation was benchmarked with previous calculations, an aluminum-water steam-explosion experiment, and test reactor steam explosion data with good agreement. Predicted pressure-pulse magnitudes evaluated were found to be several orders of magnitude lower than corresponding values evaluated by correlating available energies with shock-wave pressures from equivalent chemical detonations. The preliminary best estimate, as well as conservative estimates for RCS volume-pressurization failure and slug energetics for RCS volume-pressurization failure and slug energetics, indicated that (1) steam explosions in the ANS have significant damage potential, and (2) steam-explosion issues must be considered during the design phase of the ANS Project. Recommendations are made for efficiently addressing this important safety and design issue. 38 refs., 17 figs., 11 tabs.

53082 (SAND–90-1525C) **Core structure heat-up and material relocation in a BWR short-term station blackout accident.** Schmidt, R.C.; Dosanjh, S.S. Sandia National Labs., Albuquerque, NM (USA). [1990]. 46p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC04-76DP00789. (CONF-901101–37: American Nuclear Society winter meeting, Washington, DC (USA), 11-15 Nov 1990). Order Number DE91001226. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

This paper presents an analytical and numerical analysis which evaluates the core-structure heat-up and subsequent relocation of molten core materials during a NWR short-term station blackout accident with ADS. A simplified one-dimensional approach coupled with bounding arguments is first presented to establish an estimate of the temperature differences within a BWR assembly at the point when structural material first begins to melt. This analysis leads to the conclusions that the control blade will be the first structure to melt and that at this point in time, overall temperature differences across the canister-blade region will not be more than 200 K. Next, a three-dimensional heat-transfer model of the canister-blade region within the core is presented that uses a diffusion approximation for the radiation heat transfer. This is compared to the one-dimensional analysis to establish its compatibility. Finally, the extension of the three-dimensional model to include melt relocation using a porous media type approximation is described. The results of this analysis suggest that under these conditions significant amounts of material will relocate to the core plate region and refreeze, potentially forming a significant blockage. The results also indicate that a large amount of lateral spreading of the melted blade and canister material into the fuel rod regions will occur during the melt progression process. 22 refs., 18 figs., 1 tab.

53083 (UCRL–102683) **Accident analysis and safety review of DOE Category B reactors.** Kimura, C.Y. Lawrence Livermore National Lab., CA (USA). 7 Aug 1990. 8p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-48. (CONF-900917–18: American Nuclear Society topical meeting on safety of non-commercial nuclear reactor research and irradiation facilities, Boise, ID (USA), 30 Sep - 3 oct 1990). Order Number DE91001356. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

DOE is employing the principle of comparability with the NRC requirements to guide its safety program. Since the safety record of research reactors licensed by the NRC has been established and accepted, the comparison of DOE Orders applicable to DOE research reactors with the NRC regulations applicable to research reactors would identify strengths and weaknesses of the DOE Orders. The comparison was made in 14 general topics of safety which are labeled Areas of Safety Concerns. This paper focuses on the Area of accident analysis and safety review and presents recommendations in these areas. 12 refs.

53084 **Historical aspects of radiation accidents.** Mettler, F.A. Jr. (Dept. of Radiology, Univ. of New Mexico School of Medicine, Albuquerque, NM (US)); Ricks, R.C. pp. 17-30 of Medical management of radiation accidents. Mettler, F.A. Jr.; Kelsey, C.A.; Ricks, R.C. CRC Press Inc., Boca Raton, FL (USA) (1990). pp. 396

Radiation accidents are extremely rare events; however, the last two years have witnessed the largest radiation accidents in both the eastern and western hemispheres. It is the purpose of this chapter to review how radiation accidents are categorized, examine the temporal changes in frequency and severity, give illustrative examples of several types of radiation accidents, and finally, to describe the various registries for radiation accidents.

53085 **The Three Mile Island and Chernobyl reactor accidents.** Royal, H.D. pp. 269-292 of Medical management of radiation accidents. Mettler, F.A. Jr.; Kelsey, C.A.; Ricks, R.C. CRC Press Inc., Boca Raton, FL (USA) (1990). pp. 396

This article deals with the medical management of the Three Mile Island accident as well as the Chernobyl accident. Details are presented on how each accident happened.

53086 **Iodine partitioning in pressurized water reactor steam generator accidents.** Beahm, E.C. (Oak Ridge National Lab., Oak Ridge, TN (US)); Daish, S.R.; Shockley, W.E.; Hopenfild, J. *Nuclear Technology (USA),* 90(1): 16-22 (Apr 1990). DOE Contract AC05-84OR21400.

Measurements of iodine speciation in aqueous solution at 285°C and 1000 psig show a higher percentage as I_2 in solutions at trace concentrations than at higher concentrations. A 1×10^{-9} M I^- solution resulted in 2% I_2, whereas a 1×19^{-4} M I^- solution had only 0.1% I_2. These tests indicate that iodine at tracer concentrations can have a species distribution in solution that is not expected or observed at higher concentrations.

53087 **Measurements of radioiodine species in samples of pressurized water reactor coolant.** Voilleque, P.G. (Utility Services Operation, Science Applications International Corp., Idaho Falls, ID (US)). *Nuclear Technology (USA)*, 90(1): 23-33 (Apr 1990).

Samples of primary coolant at two pressurized water reactors in the United States have been collected and analyzed to determine the fraction of the radioiodine present in volatile forms. The volatile species, I^2 and organic iodides, would be available for prompt release following a steam generator tube rupture (SGTR) accident, which overpressurizes the secondary coolant system and causes venting to the atmosphere. Coolant samples were collected at full power, during power reduction at the start of an outage, and up to 48 h after shutdown. Radioiodine concentrations spiked as power was decreased, and an increase in the volatile species fraction to ~20% was seen with 2 h of shutdown. A second peak of 30 to 40% volatile species occurred at ~ 1.5 days after shutdown, but is not significant for SGTR accidents.

53088 **Assessment of uncertainties in early off-site consequences from nuclear reactor accidents.** Madni, I.K. (Brookhaven National Lab., Dept. of Nuclear Energy, Upton, NY (US)); Cazzoli, E.G.; Khatib-Rahbar, M. *Nuclear Technology (USA)*, 90(1): 63-77 (Apr 1990).

A simplified approach has been developed to calculate uncertainties in early off-site consequences from nuclear reactor accidents. The consequence model (SMART) is based on a solution procedure that uses simplified meteorology and involves direct analytic integration of air concentration equations over time and position. This is different from the discretization approach currently used in the CRAC2 and MACCS codes. The SMART code is fast running, thereby providing a valuable tool for sensitivity and uncertainty studies. The code was benchmarked against both MACCS version 1.4 and CRAC2. Results of benchmarketing and detailed sensitivity and uncertainty analyses using SMART are presented.

53089 **Frequency and consequences associated with a steam generator tube rupture event.** Adams, J.P. (Idaho National Engineering Lab., Idaho Falls, ID (USA)); Sattison, M.B. *Nuclear Technology (USA)*, 90(2): 168-184 (May 1990). DOE Contract AC07-76ID01570.

The results of a study into the frequency of steam generator tube rupture (SGTR) events are presented, including estimates on the upper and lower bound frequencies for U-tube and once-through steam generator plants and single- and multiple-tube ruptures. In addition, commercial pressurized water reactor operational data have been researched and iodine spiking data used to develop data bases of maximum resultant iodine concentrations and release rates. The frequencies and iodine spiking magnitudes are compared with other studies, and conclusions are drawn regarding current guidelines for analysis of this design-basis transient.

24 POWER TRANSMISSION AND DISTRIBUTION

2401 Power Systems

Refer also to citation(s) 52951

53090 (CRIE-T–89071) **Novel frequency-domain analytical technique of power system abnormal oscillations.** Takasaki, M. Central Research Inst. of Electric Power Industry, Komae, Tokyo (Japan). Energy and Environment Lab. Apr 1990. 36p. (In Japanese). Order Number DE91715329. Source: NTIS (US Sales Only), PC A03/MF A01.

A new eigenvalue analytical technique of power system abnormal oscillations was developed. Controlling characteristics of multi purpose stabilizing equipment such as SVC (static var compensator) restrict the stabilization for the main oscillation modes up to several Hz to be original object, if abnormal oscillation mode from several Hz to several hundred Hz appears. Now, a new analytical technique by which comprehensive analysis can be made for system oscillation phenomenon on wider range of frequency domain including machinery system from steady state stability to several hundred Hz, was developed. Simultanious utilization of multiple stabilizers and design coping with every oscillating mode become possible owing to this analysis. The stability limit of SVC was studied in a modl system by using this technique. Although voltage osccilation of inferior attenuation is stabilized by SVC setup, and with the increase of voltage control gain, instable oscillation generated in the control system when the gain was incresed exceeding a determined value. This analytical technique enables to examine the stability limit including every oscillation mode. 10 refs., 20 figs., 7 tabs.

53091 (EPRI-EL–6768) **Electromagnetic Transients Program (EMTP) field test comparisons: Final report.** Skliutas, J.; Panek, J. Electric Power Research Inst., Palo Alto, CA (USA); General Electric Co., Schenectady, NY (USA). ©Mar 1990. 350p. Sponsored by Electric Power Research Institute. Source: Research Reports Center, Box 50490, Palo Alto, CA 94303.

The Electromagnetic Transients Program (EMTP) is used throughout the utility industry to design and improve the operation of power systems. The objective of this project was to assess the accuracy of the EMTP by comparing field test measurements to corresponding EMTP simulations. The analysis indicates the overall accuracy of EMTP improves as the frequency range of the transient increases. The simulation accuracy is influenced by the abilities of the EMTP user to represent the system properly, and by the accuracy of data more than by EMTP models. EMTP simulations and field test measurements were compared over a wide range of applications and frequencies as selected from approximately 100 collected references. The overall accuracy is expressed in terms of deviation interval (average deviation $\pm \sigma$). The composite deviation interval for all the compared studies is −14.9% to +16.7%. The deviation intervals are determined for the individual groups into which the various studies were classified. The data is supported by extracts from the individual studies assembled in the form of fact sheets. These fact sheets also offer help to EMTP users as examples of studies grouped by subjects. 101 refs., 6 figs., 28 tabs.

53092 (VTT-TIED–1133) **Optimization of the consumption of electricity.** Tamminen, E. (Valtion Teknillinen Tutkimuskeskus, Espoo (Finland). Saehkoe- ja automaatiotekniikan Laboratorio). Valtion Teknillinen Tutkimuskeskus, Espoo (Finland). May 1990. 62p. (In Swedish). Order Number DE91707467. Source: NTIS (US Sales Only), PC A04/MF A01.

The objective for this work is to analyse how opportunities for more efficient electricity use can be properly considered in planning and optimizing electricity systems. In the short run this may entail special programs for increased efficiency. In the long run it has to be required that the normal decision processes within the economy directly lead to the result which is optimal from the point of view of citizens and consumers. Objectives for the use of electricity can only be derived from the independent goals for the whole national and energy economy. These objectives concern consumption, environment, natura resources and the risks of energy systems. Optimizing the use of electricity amounts to controlling the economy according to these objectives. This is a multi-criteria planning problem. The microeconomic theory for equilibrium can be applied here. For every effective (optimal) solution for the economy there exists a vector of market prices which leads to this effective equilibrium. If the markets are effective this solution will be realized by the economy. If we are not satisfied with the actual consumption of electricity there are three possibilities to influence it. The internal efficiency of the markets can be developed. Neglected goals, environmental goals e.g. can be expressed as market forces which apply market efficiency to work for the new goals. And finally the consumers and citizens can reconsider their preferences.

53093 (WSRC-MS-90-94) **Industrial power distribution.** Sorrells, M.A. Westinghouse Savannah River Co., Aiken, SC (USA). [1990]. 24p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC09-89SR18035. (CONF-9004249-1: Industrial power distribution seminar, Cookeville, TN (USA), 24 Apr 1990). Order Number DE91000785. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This paper is a broad overview of industrial power distribution. Primary focus will be on selection of the various low voltage components to achieve the end product. Emphasis will be on the use of national standards to ensure a safe and well designed installation.

2403 Power Transmission Lines and Cables

53094 (CRIE-T-89020) **New calculation method of voltage rise of transmission tower at lightning stroke by electromagnetic field theory.** Motoyama, H.; Matsubara, H. Central Research Inst. of Electric Power Industry, Komae, Tokyo (Japan). Energy and Environment Lab. Feb 1990. 37p. (In Japanese). Order Number DE91715330. Source: NTIS (US Sales Only), PC A03/MF A01.

In order to predict how much the transmission tower voltage rises at lightning stroke, the theoretical formula for the characteristic impedance of a transmission tower was developed by using Maxwell ' s theory. Voltage of each location of the tower was defined as one from the earth surface to the observation point. The electric field generating when rectangular wave lightning current approaches from horizontal direction to the tower was determined accurately and then characteristic impedance of each portion in the tower was determined by integrating this electric field to height direction. By regarding this tower as a cylindrical conductor vertical to the earth, the theoretical formulae of characteristic impegances to the rectangular wave current at the tower top, overhead ground wire, arm location, and between tower and transmission line were implied to clarify the aspect of time change. The voltage rise at each location of the tower to applied voltage was determined theoretically and compared with measurements at a practical transmission tower. The rised voltage value at each portion of the tower and wave form which could not sufficiently determined previously agreed well with calculated valus. 18 refs., 17 fig., 3 tabs.

53095 (EPRI-EL-6902) **Effects of voltage surges on solid-dielectric cable life.** Hartlein, R.A. (Georgia Power Co., Forest Park, GA (USA). Research Center); Harper, V.S. Electric Power Research Inst., Palo Alto, CA (USA); Georgia Power Co., Forest Park, GA (USA). Research Center. ©Sep 1990. 147p. Sponsored by Electric Power Research Institute. Source: Research Reports Center, Box 50490, Palo Alto, CA 94303.

Lightning and fault locating voltage impulses have long been thought to cause extruded underground distribution cables to fail prematurely in service. Unfortunately, the extent of this effect has never been adequately determined. The research conducted under this contract was aimed at finding the influence of simulated lightning impulses and fault locating impulses on various types of extruded underground distribution power cables aged in the laboratory. Fifteen kV cables with two insulation thickness were investigated. Insulation materials included crosslinked polyethylene (XLPE), tree resistant crosslinked polyethylene (TRXLPE), tree resistant high molecular weight polyethylene (TRHMWPE) and ethylene propylene rubber (EPR). The cables were aged up to 640 days in the laboratory using a slightly modified version of the standard AEIC accelerated water treeing test procedure. While they aged, selected cables were exposed to 40 kV, 70 kV and 120 kV rapid rise, simulated lightning impulses. Other cable samples were exposed to a fault locating impulse, and control samples were aged without the application of an impulse. The surge effect was assessed using two methods. First, the ac breakdown and impulse breakdown strength of control and impulsed samples was compared. Second, the number of impulsed cables which failed during the aging test were compared to the number of control failures. 13 refs., 76 figs.

53096 (EPRI-EL-6929) **Overload characteristics of paper-polypropylene-paper cable: Final report.** Ernst, A. (Underground Systems, Inc., Armonk, NY (USA)). Electric Power Research Inst., Palo Alto, CA (USA); Underground Systems, Inc., Armonk, NY (USA). ©Sep 1990. 47p. Sponsored by Electric Power Research Institute. Source: Research Reports Center, Box 50490, Palo Alto, CA 94303.

The short-time rating of PPP pipe-type cable may be lower than the equivalent paper cable sized to carry the same normal load. The ratings depend on the relative conductor sizes and the maximum allowable conductor temperatures of the insulation. The insulation thermal resistivity may be a significant parameter for overload times of approximately one hour and should be verified for PPP insulation. The thermal capacitance temperature characteristic of PPP insulation is not known. However, the overload ratings are not very sensitive to this parameter. Overload ratings are given for maximum conductor temperatures from 105 C to 130 C. Use of ratings based on temperatures greater than 105 C would require testing to determine the extent of degradation of the insulation at these higher temperatures. PPP-insulated cable will be thermally stable over a wider range of operating conditions (voltage and current) compared with paper-insulated cable. The short-circuit ratings of PPP- and paper-insulated cable systems and the positive/negative and zero sequence impedances are compared. 21 refs., 22 figs., 5 tabs.

2405 Environmental Aspects

Refer also to citation(s) 53924

25 ENERGY STORAGE

53097 (AD-A-224343/4/XAB) **Experimental studies leading to energy storage. Spectroscopy and dynamics of polyatomic hydrogen in liquid, solid and gaseous hydrogen plasmas. Final summary report, August 1986-July 1989.** Oka, T. Chicago Univ., IL (USA). Dept. of Chemistry. Jun 1990. 32p. Contract F04611-86-K-0069. Source: NTIS, PC A03/MF A01.

During the three years of this contract the research has been conducted in the following areas and led to significant developments. (1) We have observed infrared spectrum of ionized solid hydrogen produced by high energy (2 3 MeV) bombardment of electrons. The spectrum gave vibrational frequencies of H3+ and its hydrogen clusters in the solid. This has opened up a new method of ion spectroscopy in solids. (2) We have observed extremely sharp solid hydrogen spectral lines in nearly pure para-solid hydrogen. This was the first time that an optical spectrum was observed with such high resolution and opened a new direction in condensed phase spectroscopy and the study of intermolecular interaction.

2504 Capacitor Banks

Refer also to citation(s) 53479

2506 Thermal

53098 (TKK-F-A640) **Improved 2D numerical simulation model for strongly coupled heat and fluid flow in a thermal storage.** Kymaelaeinen, O.; Lund, P.D. Helsinki Univ. of Technology, Otaniemi (Finland). Dept. of Technical Physics. 1989. 43p. Order Number DE91707477. Source: NTIS (US Sales Only), PC A03/MF A01.

A simulation program for heat and fluid flow in a water heat storage has been developed. The simplified 2D flow equations are solved numerically using the vorticity-stream function approach. The problem is characterized by strong coupling between momentum and temperature equations. Thus, special emphasis need to be given to the speed of the solution algorithm to enable in practice the simulation of water heat storages with a reasonable throughput time. The general objective has been to develop a problem oriented simulation tool with much faster performance than the commercially available programs such as PHOENICS. The main application of the program is the visualization of flow fields for example during charging or discharging of the storage.

2509 Batteries

Refer also to citation(s) 53186

29 ENERGY PLANNING AND POLICY

Refer also to citation(s) 52724, 53141

2901 Energy Analysis and Modeling

Refer also to citation(s) 53153, 53591

2902 Economics and Sociology

Refer also to citation(s) 52926, 53103, 53123, 53124, 53125, 53127, 53128, 53129, 53131, 53144, 53145, 53146, 53148, 53149, 53153, 53175, 53641

53099 (CONF-870564–) **Proceedings of the 1987 socioeconomic energy research and analysis conference.** USDOE Office of Minority Economic Impact, Washington, DC (USA). Research and Education Div. Aug 1990. 752p. Sponsored by U.S. DOE Office of Administration and Human Resource Management. From 1987 socioeconomic energy research and analysis conference; Washington, DC (USA); 21-22 May 1987. Order Number DE91000062. Source: NTIS, PC A99/MF A01 - OSTI; GPO Dep.

The Department of Energy (the Department) convened the first Socioeconomic Energy Research and Analysis Conference in May 1987, in the spirit of constructive dialogue and mutual concern about numerous energy issues and problems. The objective was to provide a national forum for illuminating specific energy and related socioeconomic issues of our nation and discussing realistic approaches to energy policy assessments. This action was based on the Department's commitment to lead the way in developing a pragmatic framework or energy policy determinations, by incorporating constructive policy impact assessment methods into the decisionmaking process. In this rapidly developing industry with high energy technologies, a strong federal role and targeted government programs are essential for the development and integration of minorities into various industry segments. Furthermore, a responsive energy program for all segments of the population must be sensitive to (a) the impact of energy policies on the overall growth of the economy; (b) the differential impact of energy policies on various industries; and (c) the pattern of change in the structure of the social environment. The socioeconomic researchers and energy policy analysts who presented papers or participated in this national forum assisted the Department's efforts to build an energy structure which is truly responsive to the needs of the various population segmets of our nation. The conference participants were also given the opportunity to critique some unique energy policy assessment methodologies which have been conducted mainly at Argonne National Laboratory, under the sponsorship and guidance of the Research and Education Divisions of my Office. Individual papers, in this proceedings have been cataloged separately.

53100 (DOE/EIA–0376(88)) **State energy price and expenditure report 1988.** USDOE Energy Information Administration, Washington, DC (USA). Office of Energy Markets and End Use. 27 Sep 1990. 249p. Sponsored by U.S. DOE Energy Information Administration. Order Number DE91000925. Source: NTIS, PC A11/MF A01 - GPO - OSTI; GPO Dep.

The State Energy Price and Expenditure Report (SEPER) presents energy price and expenditure estimates for the 50 states, the District of Columbia, and the United States. The estimates are provided by energy source and economic sector. This report is an update of the State Energy Price and Expenditure Report 1987 published in September 1989. Changes from the last report, other than the routine addition of the 1988 estimates, are summarized in a section of the documentation. Expenditures are calculated by multiplying the price estimates by the consumption estimates, adjusted to remove process fuel and intermediate product consumption. All expenditures are consumer expenditures, that is, they represent estimates of money directly spent by consumers to purchase energy, generally including taxes. The five economic sectors used in SEPER are as follows: Residential Sector – Private household establishments, which consume energy primarily for space heating, water heating, air conditioning, lighting, refrigeration, cooking, and clothes drying. Commercial Sector – Nonmanufacturing business establishments, including hotels, motels, restaurants, wholesale businesses, retail stores, laundries, and other service enterprises; health, social, and educational institutions; and federal, state, and local governments. Street lights, pumps, bridges, and public services are also included. Industrial Sector – Manufacturing, construction, mining, agriculture, fishing, and forestry establishments. Transportation Sector – Private and public vehicles that move people and commodities. Included are automobiles, trucks, buses, motorcycles, railroads and railways (including streetcars), aircraft, ships, barges, and natural gas pipelines. Electric Utility Sector – Privately and publicly owned establishments that generate electricity primarily for use by the public.

53101 (IEACR–27) **Market mechanisms for pollution control: Impacts on the coal industry.** Vernon, J.L. IEA Coal Research, London (UK). ©Aug 1990. 38p. Sponsored by International Energy Agency. Source: IEA Coal Research, Gemini House, 10-18 Putney Hill, London SW15 6AA, United Kingdom.

The aim of this report is to examine the use of market mechanisms for pollution control. That is, regulatory approaches which harness the power of the market to modify consumption and production patterns so that they are more environmentally benign, by ensuring that prices of goods and services reflect the value of environmental resources used in their production. The report seeks to explain the background to current interest in market mechanisms, evaluating their claimed benefits compared with traditional regulation and standards. The focus of the report is on market mechanisms with potential impacts on the coal industry. 31 refs., 12 tabs.

53102 (IFP–35-066) **Model on economical growth, energy and debt in the developing countries: Application to Indonesia.** Fevrier, S. Institut Francais du Petrole (IFP), 92 - Rueil-Malmaison (France). Apr 1986. 488p. (In French). Order Number DE88751891. Source: NTIS (US Sales Only), PC A21/MF A01 - OSTI.

An economical, energetical and financial model have been developed in order to simulate the economics of a developing country as a function of various parameters such as energy elasticity, sectorial increment value growth ratio, etc. The model is based on a fundamental relation between economical growth, energy and national debt. The formulation of the model is also based on the RMSM model (Revised Minimum Standard Model) constructed in the seventies. A case study (Indonesia) points out the deficiencies of the RMSM model.

2903 Environment, Health, and Safety

Refer also to citation(s) 52855, 52860, 52864, 52876, 52880, 52881, 53101, 53125, 53128, 53130, 53149, 53604, 53605, 53606, 53607, 53608, 53609, 53610, 53611, 53612, 53613, 53614, 53615, 53616, 53617, 53618, 53619, 53620, 53621, 53622, 53623, 53624, 53625, 53626, 53627, 53628, 53629, 53630, 53631, 53647, 53650, 53651, 53653, 53658, 53659, 53660, 53661, 53662, 53671, 53677, 53692, 53693, 53694, 53708, 53709, 53710, 53711, 53712, 53713, 53714, 53715, 53716, 53717, 53718, 53719, 53720, 53721, 53722, 53723, 53724, 53725, 53726, 53727, 53728, 53729, 53730, 53731, 53732, 53733, 53734, 53735, 53736, 53737, 53738, 53739, 53740, 53741, 53742, 53743, 53744, 53745, 53746, 53747, 53748, 53749, 53750, 53751, 53752, 53753, 53754, 53755, 53758, 53759, 53770, 53775, 54182

53103 (CONF-9008119–1) **Citizen advisory groups: Improving their effectiveness.** Peelle, E. Oak Ridge National Lab., TN (USA). [1990]. 13p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From 12. annual DOE low level waste management conference; Chicago, IL (USA); 28-29 Aug 1990. Order Number DE91000619. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

In an age of citizen distrust of government and intense NIMBY (not-in-my-backyard) activity when waste management facilities are proposed, the potential of citizen advisory groups (CAGs) to aid

the decision-making process is worth exploring. This paper reviews findings from case studies by the author and others to assess the various purposes, pitfalls, advantages and outcomes of CAGs in influencing decisions about controversial waste management actions and facilities. Advantages and disadvantages of the CAG are evaluated as one of several public participation mechanisms. We outline ways in which CAGs can aid the waste management decision process and develop minimum requirements for the successful functioning of citizen advisory groups in decision processes with significant technical components, such as those involving nuclear and hazardous wastes. 18 refs., 1 tab.

53104 (DOE/EIS–0131-Vol.1) **Initial Northwest Power Act power sales contracts: Volume 1, Environmental analyses: Draft environmental impact statement.** USDOE Bonneville Power Administration, Portland, OR (USA). Aug 1990. 236p. Sponsored by U.S. DOE Conservation & Renewable Energy. Order Number DE91000752. Source: NTIS, PC A11/MF A01 - OSTI; GPO Dep.

In 1981, BPA offered its customers long-term contracts pursuant to the requirements of the Pacific Northwest Electric Power Planning and Conservation Act (Northwest Power Act). BPA published a Final Environmental Report to accompany the initial contract offer but did not prepare an Environmental Assessment (EA) or an Environmental Impact Statement (EIS). In 1981, an environmental group, Forelaws on Board, charged that BPA's failure to prepare an EIS on the offered contracts violated the National Environmental Policy Act (NEPA). In 1984, the United States Court of Appeals for the Ninth Circuit ordered BPA to prepare an EIS, but allowed BPA and its customers to continue operating under the contracts. Since the Court's Order left the contracts in place, the EIS will be used to inform BPA, customers, the Northwest Power Planning Council, and the public of the potential environmental consequences of the contracts and will guide future actions. The EIS provides a mid-term evaluation of these existing contracts to determine if they should be preserved or changed. First would come completion of the EIS and a decision either ratifying the existing contracts or noting areas of concern. Second, if necessary, BPA would conduct a process to examine ways to address the impacts in such area of concern by contract amendments or non-contractual methods. The EIS analyzes BPA's two broad alternatives: first, to preserve the contracts without change (the No Action Alternative) or, second, to pursue modifications. Within the second alternative are five categories corresponding to major policy issues: (1) hydro development and operations; (2) conservation; (3) resource planning and development; (4) quality of service as a resource choice; and (5) industrial load constraints. 2 figs., 22 tabs.

53105 (DOE/EIS–0131-Vol.3) **Initial Northwest Power Act power sales contracts: Draft environmental impact statement: Volume 3, Appendix M, Contract copies.** USDOE Bonneville Power Administration, Portland, OR (USA). Aug 1990. 301p. Sponsored by U.S. DOE Conservation & Renewable Energy. (DOE/BP–1305). Order Number DE91000754. Source: NTIS, PC A14/MF A01 - OSTI; GPO Dep.

In 1981, BPA offered its customers long-term contracts pursuant to the requirements of the Pacific Northwest Electric Power Planning and Conversation Act (Northwest Power Act). BPA published a Final Environmental Report to accompany the initial contract offer but did not prepare an Environmental Assessment (EA) or an Environmental Impact Statement (EIS). In 1981, an environmental group, Forelaws on Board, charged that BPA's failure to prepare an EIS on the offered contracts violated the National Environmental Policy Act (NEPA). In 1984, the United States Court of Appeals for the Ninth Circuit ordered BPA to prepare an EIS, but allowed BPA and its customers to continue operating under the contracts. Since the Court's Order left the contracts in place, the EIS will be used to inform BPA, customers, the Northwest Power Planning Council, and the public of the potential environmental consequences of the contracts and will guide future actions. The EIS provides a mid-term evaluation of these existing contracts to determine if they should be preserved or changed. First would come completion of the EIS and a decision either ratifying the existing contracts or noting areas of concern. Second, if necessary, BPA would conduct a process to examine ways to address the impacts in such area of concern by contract amendments or non-contractual methods. The EIS analyzes BPA's two broad alternatives: first, to preserve the contracts without change (the No Action Alternative) or, second, to pursue modifications. Within the second alternative are five categories corresponding to major policy issues: (1) hydro development and operations; (2) conservation; (3) resource planning and development; (4) quality of service as a resource choice; and (5) industrial load constraints. This is Appendix M, Contract Copies.

53106 (ORNL–6608/R6) **Environmental Regulatory Update Table, July 1990.** Houlberg, L.M.; Nikbakht, A.; Salk, M.S. Oak Ridge National Lab., TN (USA). Aug 1990. 100p. Sponsored by U.S. DOE Environment Health & Safety. DOE Contract AC05-84OR21400. Order Number DE91000547. Source: NTIS, PC A06/MF A01 - OSTI; GPO Dep.

Environmental Sciences Division Publication No. 3447.

The Environmental Regulatory Update Table provides information on regulatory initiatives of interest to DOE operations and contractor staff with environmental management responsibilities. The table is updated each month with information from the Federal Register and other sources, including direct contact with regulatory agencies. Each table entry provides a chronological record of the rulemaking process for that initiative with an abstract and a projection of further action.

53107 (ORNL–6608/R7) **Environmental Regulatory Update Table, August 1990.** Houlberg, L.M.; Nikbakht, A.; Salk, M.S. Oak Ridge National Lab., TN (USA). Sep 1990. 113p. Sponsored by U.S. DOE Environment Health & Safety. DOE Contract AC05-84OR21400. Order Number DE91001005. Source: NTIS, PC A06/MF A01; OSTI; INIS; GPO Dep.

Environmental Sciences Division Publication No. 3447.

The Environmental Regulatory Update Table provides information on regulatory initiatives of interest to DOE operations and contractor staff with environmental management responsibilities. The table is updated each month with information from the Federal Register and other sources, including direct contact with regulatory agencies. Each table entry provides a chronological record of the rulemaking process for that initiative with an abstract and a projection of further action.

53108 (ORNL–6608/R8) **Environmental Regulatory Update Table, September 1990.** Houlberg, L.M.; Nikbakht, A.; Salk, M.S. Oak Ridge National Lab., TN (USA). Oct 1990. 111p. Sponsored by U.S. DOE Environment Health & Safety. DOE Contract AC05-84OR21400. Order Number DE91000537. Source: NTIS, PC A06/MF A01 - OSTI; GPO Dep.

Environmental Sciences Division Publication No. 3447.

The Environmental Regulatory Update Table provides information on regulatory initiatives of interest to DOE operations and contractor staff with environmental management responsibilities. The table is updated each month with information from the Federal Register and other sources, including direct contact with regulatory agencies. Each table entry provides a chronological record of the rulemaking process for that initiative with an abstract and a projection of further action.

53109 (ORNL/FTR–3784) **[Environmental impact assessment as applied to policies, plans and programs]: Foreign trip report, October 1, 1990–October 3, 1990.** Sigal, L.L. Oak Ridge National Lab., TN (USA). 19 Oct 1990. 11p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE91001372. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A proposal to study the application of the principles of environmental impact assessment (EIA) to policy, plans, and programs was submitted by the US Environmental Protection Agency (EPA) to the Senior Advisors on Environmental and Water Problems of the United Nations Economic Commission. On approval, EPA asked Oak Ridge National Laboratory (ORNL) to support its efforts as lead participant on an international task force. ORNL is responsible for overall project management, including development of the report. At the first meeting in Geneva on June 18–19, there were representatives from Austria, Canada, Finland, Norway, Poland, Sweden, and the United Kingdom. The administrative/legal setting for EIA in each country was reviewed. The objectives of the task force were defined, and issues related to the application of EIA at

the policy level were discussed. At the second meeting, in addition to those countries represented at the first meeting the Commission of Economic Communities, Czech and Slovak Federal Republic, Remark, Federal Republic of Germany, Hungary, and The Netherlands were represented. A brief review was given by the new participants of legal/administrative requirements for EIA in their countries. Case studies were presented by Canada, Finland, The Netherlands, Norway, Sweden, and the United States.

53110 (PB–90-242876/XAB) **Site Enforcement Tracking System (SETS): PRP listing by site for Region 1.** Environmental Protection Agency, Washington, DC (USA). Office of Waste Programs Enforcement. 2 Aug 1990. 471p. Source: NTIS, PC EE99/MF E99.

Set includes PB–90-242884 through PB–90-242934.

A separate abstract is included for each of the 6 reports of this set.

53111 (PB–90-243130/XAB) **Site Enforcement Tracking System (SETS): PRP listing by site for Region 5.** Environmental Protection Agency, Washington, DC (USA). Office of Waste Programs Enforcement. 2 Aug 1990. 556p. Source: NTIS, PC EE99/MF E99.

Set includes PB–90-243148 through PB–90-243197.

A separate abstract is included for each of the 6 volumes of this set.

53112 (PB–90-258492/XAB) **Report to Congress on special wastes from mineral processing: Summary and fundings, method and analyses; appendices.** Environmental Protection Agency, Washington, DC (USA). Office of Solid Waste. Jul 1990. 644p. (EPA–530/SW-90/070C). Source: NTIS, PC A99/MF A04.

Portions of this document are not fully legible.

The report addresses the following 8 study factors required by Section 8002(p) of RCRA for the 20 mineral processing wastes: (1) the sources and volumes of such materials generated per year; (2) present disposal and utilization practices; (3) potential danger to human health and the environment from the disposal and reuse of such materials; (4) documented cases in which danger to human health or the environment has been proven; (5) alternatives to current disposal methods; (6) the costs of such alternatives; and (7) the impacts of these alternatives on the use of phosphate rock, uranium ore, and other natural resources; and (8) the current and potential utilization of such materials.

53113 (PB–90-263120/XAB) **Directory of public libraries. Toxic chemical release inventory.** Environmental Protection Agency, Washington, DC (USA). Information Management Div. Feb 1990. 170p. (EPA–560/7-90/005). Source: NTIS, PC A08/MF A01.

The Directory of Public Libraries is a compilation of over 2,300 libraries designated by each State's Librarian to receive their state's microfiche containing data collected under Section 313 (j) of the Emergency Planning and Community Right-to-Know Act (EPCRA) Title III of the Superfund Amendments and Reauthorization Act of 1986–Public Law 99-499. Section 313 (j) of EPCRA requires EPA to establish the National Toxic Chemical Release Inventory (TRI) and to make the data/information collected annually available to the public through computer telecommunications and other means. TRI is distributed, sold and available in many different forms–online through the National Library of Medicine, CD-ROM, dBase, and Lotus floppy diskettes, microfiche, magnetic tape. It is accessible to the public in one or more of these forms from thousands of locations nationwide, as well as several international locations, of which this Directory identifies over 40% of those locations.

53114 (PB–90-267303/XAB) **Energy and Environment 1990: Transportation-induced noise and air pollution.** National Research Council, Washington, DC (USA). Transportation Research Board. 1990. 149p. (TRB/TRR–1255). Source: NTIS, PC A07/MF A01.

Library of Congress catalog card No. 90-40567.

Contents: public reaction to low levels of aircraft noise; airport noise insulation of homes surrounding stapleton international airport; sound insulation and thermal performance modifications: case study for three dwellings near bwi airport; single-number ratings for outdoor-indoor sound insulation; control of wheel squeal noise in rail transit cars; knowledge-based preprocessor for traffic noise prediction; barrier overlap analysis procedure; atmospheric effects on traffic noise propagation; predicting stop-and-go traffic noise with stamina 2.0; feasibility of transparent noise barriers; field testing of the effectiveness of open-graded asphalt pavement in reducing tire noise from highway vehicles; cost of noise barrier construction in the united states; comparisons of emissions of transit buses using methanol and diesel fuel; high-speed rail system noise assessment; energy-related, environmental, and economic benefits of florida's high-speed rail and maglev systems proposals.

2904 Energy Resources

Refer also to citation(s) 52716, 52876, 53124, 53765

53115 (PB–90-928107/XAB) **Soviet Energy Data Resource Handbook: A reference aid.** Central Intelligence Agency, Washington, DC (USA). May 1990. 45p. (SOV–90-10021). Source: NTISStanding Order.

Color illustrations reproduced in black and white.; Paper copy available on Standing Order, deposit account required (Minimum deposit $100 North American Continent; $200 all others). This series offers a reduction in price as a Standing Order, PB–90-928100.

The USSR is the world's largest energy producer and ranks second in total energy consumption behind the United States. It has the largest oil reserves of any country outside the Middle East, leads the world in gas reserves, and contains enormous–albeit relatively low quality–coal resources. The USSR currently stands in third place after the United States and France in installed nuclear generating capacity, and only Canada and the United States produce more electricity than the USSR from hydropower plants. Natural gas is the leading source of energy for the domestic economy, followed closely by oil. Energy exports are the principal source of foreign exchange earnings for the USSR. The 1990s will be a difficult period for the Soviet energy industries. Oil production is declining, growth in gas output has slowed, coal production–in terms of energy content–has been stagnant for years, and the nuclear power program has been retarded by growing antinuclear sentiment. Moreover, the costs of energy development are rising rapidly.

2905 Research, Development, Demonstration, and Commercialization

Refer also to citation(s) 53134, 53150, 53151, 53157, 53161, 53339

53116 (SA-PUB–7/1988) **Evaluation of basic research in the energy field in Finland.** Suomen Akatemja, Helsinki (Finland). 1988. 53p. Order Number DE91707460. Source: NTIS (US Sales Only), PC A04/MF A01.

The Academy of Finland and the Ministry of Trade and Industry decided in autumn 1986, on the initiative of the Ministry of Trade and Industry, to evaluate basic research in the energy field in Finland. A steering committee was set up by the Research Council for Technology to plan and supervise the evaluation. The committee consisted of Dr. Seppo Hannus, Head of Office, the ministry of Trade and Industry, Professor Risto Keskinen and Professor Tapio Westerlund and Ms. Sisko Loikkanen, Planning Officer at the Academy of Finland. The Research Council for Technology appointed Professor Risto Keskinen the chairman of of the steering committee. The Council also appointed Professor Emeritus Osmo Hassi the coordinator and Dr. Erkki Anttila from the Tampere University Technology the scientific secretary of the steering committee. The research groups and researchers within the fields to be evaluated were asked to give proposals for the members of the evaluation committee. The steering committee made a tentative proposal for experts whereupon the Research Council for Technology appointed the following foreign experts to the evaluation committee: Professor Bjoern F. Magnussen (Norway), Professor Janos M. Beer (USA), Professor Thomas M Lee (Austria) and Professor Esteban Chornet (Canada). The evaluation committee elected Professor Bjorn Magnussen from Norway its chairman. The steering committee chose the research fields, research groups and research institutes to be included in the evaluation. The universities

and research institutes were also given opportunity to propose further research groups for evaluation. The research groups being evaluated supplied the experts with written material in September 1987. The experts visited the laboratories and acquainted themselves with the work of the research groups under evaluation during May 23-28, 1988. The evaluation Committee submitted its final report on June 30, 1988.

2906 Nuclear Energy

Refer also to citation(s) 53024, 53025, 53601

53117 (DOE/EIA–0438(90)) **Commercial nuclear power 1990: Prospects for the United States and the world.** USDOE Energy Information Administration, Washington, DC (USA). Office of Coal, Nuclear, Electric and Alternate Fuels. 28 Sep 1990. 135p. Sponsored by U.S. DOE Office of Administration and Human Resource Management. Order Number DE91000877. Source: NTIS, PC A07/MF A01 - GPO; OSTI; INIS; GPO Dep.

This report presents the status at the end of 1989 and the outlook for commercial nuclear capacity and generation for all countries in the world with free market economies (FME). The report provides documentation of the US nuclear capacity and generation projections through 2030. The long-term projections of US nuclear capacity and generation are provided to the US Department of Energy's (DOE) Office of Civilian Radioactive Waste Management (OCRWM) for use in estimating nuclear waste fund revenues and to aid in planning the disposal of nuclear waste. These projections also support the Energy Information Administration's annual report, Domestic Uranium Mining and Milling Industry: Viability Assessment, and are provided to the Organization for Economic Cooperation and Development. The foreign nuclear capacity projections are used by the DOE uranium enrichment program in assessing potential markets for future enrichment contracts. The two major sections of this report discuss US and foreign commercial nuclear power. The US section (Chapters 2 and 3) deals with (1) the status of nuclear power as of the end of 1989; (2) projections of nuclear capacity and generation at 5-year intervals from 1990 through 2030; and (3) a discussion of institutional and technical issues that affect nuclear power. The nuclear capacity projections are discussed in terms of two projection periods: the intermediate term through 2010 and the long term through 2030. A No New Orders case is presented for each of the projection periods, as well as Lower Reference and Upper Reference cases. 5 figs., 30 tabs.

53118 (LBL–29446) **Evolution of federal support of science.** Seaborg, G.T. Lawrence Berkeley Lab., CA (USA). Aug 1990. 33p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-9008160–1: 200. ACS symposium on the establishment of research support agencies, Washington, DC (USA), 30 Aug 1990). Order Number DE91000233. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

"Evolution of Federal Support of Science" is Dr. G. T. Seaborg's speech presented at the symposium on the Establishment of Research Support Agencies, held on August 30, 1990, in Washington, DC. He gives a brief history on the development of nuclear energy from the discovery of fission in 1938 to the completion of uranium bombs in 1944. He also covered the scientific activities during the war, which included the establishment of National Defense Research Committee, the Office of Scientific Research and Development, and the Atomic Energy Act. He discussed the debate between the "little science" and the "big science," which requires hundreds of billions of dollars, such as the superconducting super collider. Dr. Seaborg believes that our country can afford to support both research activities, if we could reduce the expenses of military expansion. 22 figs.

2910 Conservation

Refer also to citation(s) 53131, 53148, 53150, 53153, 53157, 53175

2920 Supply, Demand, and Forecasting

Refer also to citation(s) 52760, 53099, 53121, 53127, 53150

2930 Policy, Legislation, and Regulation

Refer also to citation(s) 53130

2940 Fossil Fuels

Refer also to citation(s) 52675, 52690, 52731, 52737, 52738, 52748, 52749, 53100, 53127, 53591

53119 (DOE/EIA–0216(89)) **US crude oil, natural gas, and natural gas liquids reserves: Annual report, 1989.** USDOE Energy Information Administration, Washington, DC (USA). Office of Oil and Gas. 5 Oct 1990. 109p. Sponsored by U.S. DOE Office of Administration and Human Resource Management. Order Number DE91001303. Source: NTIS, PC A06/MF A01 - GPO - OSTI; GPO Dep.

This report presents estimates of proved reserves of crude oil, natural gas, and natural gas liquids as of December 31, 1989, and production volumes for the year 1989 for the total United States and for selected states and state sub-divisions. Estimates are presented for the following four categories of natural gas: total gas (wet after lease separation), its two major components (nonassociated and associated-dissolved gas), and total dry gas (wet gas adjusted for the removal of liquids at natural gas processing plants). In addition, two components of natural gas liquids, lease condensate and natural gas plant liquids, have their reserves and production reported separately. Also included is information on indicated additional crude oil reserves and crude oil, natural gas, and lease condensate reserves in nonproducing reservoirs. 28 refs., 9 figs., 15 tabs.

53120 (DOE/EIA–0538(90/91-03)) **Winter fuels report, week ending October 12, 1990.** USDOE Energy Information Administration, Washington, DC (USA). Office of Oil and Gas. 18 Oct 1990. 62p. Sponsored by U.S. DOE Office of Administration and Human Resource Management. Order Number DE91001103. Source: NTIS, PC A04/MF A01 - OSTI; GPO Dep.

The Winter Fuels Report is intended to provide concise, timely information to the industry, the press, policymakers, consumers, analysts, and state and local governments on the following topics: distillate fuel oil net production, imports and stocks for all PADD's and product supplied on a US level; propane net production, imports and stocks for Petroleum Administration for Defense Districts (PADD) I, II, and III; natural gas supply and disposition and underground storage for the United States and consumption for all PADD's; residential and wholesale pricing data for propane and heating oil for those states participating in the joint Energy Information Administration (EIA)/State Heating Oil and Propane Program; crude oil and petroleum price comparisons for the United States and selected cities; and US total heating degree-days by city.

53121 (EPRI-P–6820) **Natural gas for electric power generation: Strategic issues, risks and opportunities.** Foley, D.J. (Pace Consultants, Inc., Houston, TX (USA)); Hughes, W.R.; Jensen, J.T.; Mueller, H.A.; Oatman, E.N.; Thumb, S.L. Electric Power Research Inst., Palo Alto, CA (USA); Strategic Decisions Group, Menlo Park, CA (USA). ©1990. 44p. Sponsored by Electric Power Research Institute. Source: Research Reports Center, Box 50490, Palo Alto, CA 94303.

Natural gas is again being regarded as a significant fuel for electric power generation. It was once a predominant fuel for utilities in gas-producing areas, but natural gas consumption declined greatly after the 1973 oil shock because of reduced electricity demand and increased coal and nuclear generation. Moreover, wellhead price and other forms of regulation produced gas shortages in the 1970s. In the 1980s, customer response to pessimistic supply forecasts and new regulatory initiatives such as the Industrial Fuel Use Act actually produced a gas supply surplus. Today, freed from most of these regulations, natural gas has become the short-term safety valve for meeting future demand growth by both utilities and independent power producers in all regions. Natural gas, if available and attractively priced, is an ideal fuel for electric power generation. No other fuel shares these attractive characteristics, and utilities, facing higher than expected load growth, are relying on an increasing proportion of gas-fired combustion turbines, combined cycle plants, and cogeneration to meet a growing, yet

uncertain, future demand for electricity. This report, which summarizes the major findings from these research efforts, is intended to help utility decision-makers understand the full range of risks they face with natural gas electric power generation and to identify actions they can take to mitigate those risks.

53122 (VTT-SYMP–107, pp. 47-65) **Lignite, low-grade coals and peat, an overview of resources, power generation and upgrading.** Couch, G.R. (IEA Coal Research, London (United Kingdom)). Valtion Teknillinen Tutkimuskeskus, Espoo (Finland). 1989. (CONF-890668–Vol.1: Symposium on low-grade fuels, Helsinki (Finland), 12-16 Jun 1989). In *Low-grade fuels: Volume 1.* 376p. Order Number DE91707607. Source: NTIS (US Sales Only), PC A17/MF A01.

Deposits of lignite/brown coal, low-grade coals and peat are widely distributed around the world and their use is of growing importance. The environmental effects of their use stem principally from the use of surface mining for extraction and from the ash impurities present. Low-grade coals commonly have a high ash content and this gives rise to subsequent processing, air pollution control and waste disposal problems. Both low-rank and low-grade coals are variable in nature. Ash composition, sulphur content and other properties can vary widely within a deposit. They are more variable than, for example, bituminous coals and oil. They are not internationally traded and hence there is no standard system of classification or characterisation. The behaviour of the ash components in any process for usage will probably be the key to the eventual economics. Characterisation of the ash and prediction of its behaviour at high temperatures is not easy. The principal use for lignites, worldwide, is for power generation. There is considerable effort to develop upgrading processes which would increase the energy densit and could improve the economics of transportation. With a low-grade fuel it is not normally possible to solve technical problems economically by fuel switching. Often the only option is to use a proportion of a more expensive, higher grade fuel. Technology transfer from one situation to another faces greater uncertainties than with bituminous coals. Providing there is a clear appreciation of the technological limitations, low-rank, low-grade fuels can provide a secure and cost-effective fuel source.

53123 (VTT-SYMP–107, pp. 13-46) **Economic significance of coal and low-grade solid fuels.** Slavov, S. (United Nations, Geneve (Switzerland). Economic Commission For Europe). Valtion Teknillinen Tutkimuskeskus, Espoo (Finland). 1989. (CONF-890668–Vol.1: Symposium on low-grade fuels, Helsinki (Finland), 12-16 Jun 1989). In *Low-grade fuels: Volume 1.* 376p. Order Number DE91707607. Source: NTIS (US Sales Only), PC A17/MF A01.

This paper describes the general energy perspectives and economic importance in coal in meeting energy needs in Europe, North America and in the world by the end of the century and beyond. At present, coal is the second most important source of primary energy but there are indications that coal may become the "number 1" fuel again as of the new century. By 2020, coal might cover 31-32 per cent of the primary energy needs in Europe and North America on the assumption that coal's ample, economically recoverable reserves enhance coal's competitive position with regard to oil. One of the reasons for projecting a further absolute and relative growth of coal demand and supply is the availability of significant reserves of low-calorie value solid fuels (brown coal and lignite with calorific value between 1000-2500 kcal/kg), located in Central Europe, the Balkan region and the USSR. Their extraction is less expensive than underground mining due to the application of high-productivity open-cast mining. By the end of 2000, low-grade coal production in Europe and North America could attain 600 million tce or 25 per cent of total solid fuel consumption in this region. Accomplishment of this ambitious objective, however, depends almost exclusively on the availability of technologies for the environmentally acceptable and efficient utilization of low-calorie value solid fuels. Such technologies and control equipment to meet stringent environmental regulations can add up to 25-30 per cent of the investment cost of a new power plant and 25-25 per cent of electricity generation costs and thus, diminish the price competitiveness of coal vis-a-vis other energy sources.

2950 Hydrogen and Synthetic Fuels

Refer also to citation(s) 53189

2960 Electric Power

Refer also to citation(s) 52816, 52817, 52818, 52819, 52820, 52821, 52822, 52823, 52824, 52825, 52826, 52827, 52828, 52829, 52830, 52831, 52832, 52833, 52834, 52835, 52836, 52837, 52838, 52839, 52840, 52841, 52842, 52953, 53100, 53104, 53105, 53121, 53147, 53148

53124 (DOE/BP–1423) **Proposed revenues, financial strategy, and program costs for FY 1992 and 1993: Staying fit for the long run: Technical Appendix: BPA Programs in Perspective.** USDOE Bonneville Power Administration, Portland, OR (USA). Jul 1990. 60p. Sponsored by U.S. DOE Office of Administration and Human Resource Management; U.S. DOE Bonneville Power Administration. Order Number DE91000194. Source: NTIS, PC A04/MF A01 - OSTI; GPO Dep.

Programs in Perspective is the Bonneville Power Administration's public involvement process (PIP) for engaging customers and other stakeholders in a regional dialog to set strategic direction and broad program plans for BPA effort. This planning leads into a biennial rate setting cycle and offers a more accessible and flexible opportunity for dialog on broad issues than is possible under the strict administrative procedures of ratemaking. The self-financed character of BPA has made this public process a necessary and valuable one to assure that those who pay BPA's rates have a clear understanding and a strong voice in the plans for use of the resulting revenues. During 1989, the previous PIP engaged the region in discussion of major strategic, issues focussing on major areas. In 1990, BPA seeks discussion of the directions and plans specifically for fiscal years 1992 and 1993. The steps taken for those years will lay the foundation for the years beyond. Thus, we have subtitled this year's process, "Staying fit for the long run." We have consulted extensively with customers and others in the region in developing these plans. In dozens of program–specific meetings, BPA staff have talked and listened to what others think our plans ought to be. PIP now gives us a chance to review their sum total, along with projections for revenues and our overall financial position. 8 tabs., 8 figs.

53125 (DOE/BP/66141–3) **Meeting the Northwest's energy needs through competitive bidding.** McCoy, G.A.; Bloomquist, R.G. Washington State Energy Office, Olympia, WA (USA). Jul 1990. 21p. Sponsored by U.S. DOE Office of Administration and Human Resource Management. DOE Contract BI79-87BP66141. Order Number DE91000804. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Utilities have traditionally met load growth requirements through building projects (self-build), purchasing power from other utilities, or from running conservation programs. During the 1980s, alternative capacity expansion approaches were developed. Resources are now also obtained through PURPA-based or competitive bidding acquisition programs. Self-build programs typically involve large-scale hydropower; coal-, natural gas-, and oil-fired projects; and nuclear thermal electric generating projects. Characteristics of these projects, in addition to size, include long lead times, capital intensiveness, substantial environmental impacts, and a significant risk of cost overruns. The risk element became immediately apparent to those investor-owned utilities that, because of decreased load growth, had thermal project investments disallowed in rate cases or were forced to terminate projects. Phrases such as "prudent investment," "used and useful," and "least-cost planning" became familiar to the utility industry. Many utilities, once burned, subsequently adopted a policy of never again constructing a base-loaded generating plant. 2 figs.

53126 (DOE/EIA–0095(89)) **Inventory of power plants in the United States 1989.** USDOE Energy Information Administration, Washington, DC (USA). Office of Coal, Nuclear, Electric and Alternate Fuels. 21 Sep 1990. 388p. Sponsored by U.S. DOE Office of Administration and Human Resource Management. Order Number DE91000630. Source: NTIS, PC A17/MF A01 - GPO - OSTI; GPO Dep.

This document is prepared annually by the Electric Power Division, Office of Coal, Nuclear, Electric and Alternate Fuels, Energy Information Administration (EIA), US Department of Energy (DOE). The purpose of this publication is to provide year-end statistics about electric generating units in operation and to provide a 10-year outlook of future generating unit additions by electric utilities in the United States (the 50 states and the District of Columbia). Data summarized in this report are useful to a wide audience including Congress, federal and state agencies, the electric utility industry, and the general public. The data presented in this report were assembled and published by the EIA, to fulfill its data collection and dissemination responsibilities as specified in the Federal Energy Administration Act of 1974 (Public Law 93-275) as amended. The report is organized into the following chapters: Summary Statistics; Operable Electric Generating Units; and Projected Electric Generating Unit Additions.

53127 (DOE/EIA–0226(90/07)) **Electric Power Monthly, July 1990.** USDOE Energy Information Administration, Washington, DC (USA). Office of Coal, Nuclear, Electric and Alternate Fuels. 12 Oct 1990. 194p. Sponsored by U.S. DOE Office of Administration and Human Resource Management. Order Number DE91001494. Source: NTIS, PC A09/MF A01 - GPO - OSTI; GPO Dep.

The Electric Power Monthly (EPM) is prepared by the Electric Power Division; Office of Coal, Nuclear, Electric and Alternate Fuels, Energy Information Administration (EIA), Department of Energy. This publication provides monthly statistics at the national, Census division, and State levels for net generation, fuel consumption, fuel stocks, quantity and quality of fuel, cost of fuel, electricity sales, and average revenue .per kilowatthour of electricity sold. Data on net generation are also displayed at the North American Electric Reliability Council (NERC) region level. Additionally, company and plant level information are published in the EPM on capability of new plants, net generation, fuel consumption, fuel stocks, quantity and quality of fuel, and cost in fuel. Quantity, quality, and cost of fuel data lag the net generation, fuel consumption, fuel stocks, electricity sales, and average revenue per kilowatthour data by 1 month. This difference in reporting appears in the national, Census division, and State level tables. However, at the plant level, all statistics presented are for the earlier month for the purpose of comparison. 12 refs., 4 figs., 48 tabs.

53128 (DOE/EIS–0131-Vol.2) **Initial Northwest Power Act power sales contracts: Volume 2, Appendices A-L: Draft environmental impact statement.** USDOE Bonneville Power Administration, Portland, OR (USA). Aug 1990. 643p. Sponsored by U.S. DOE Conservation & Renewable Energy. Order Number DE91000753. Source: NTIS, PC A99/MF A01 - OSTI; GPO Dep.

This report is the appendices of Bonneville Power Administration's previous report on "environmental impact statement," "power sales contracts," and Initial Northwest power act." It covers the Ninth Circuit Court opinion in "forelaws on board v. Johnson;" guide to Northwest Power Act contracts; the operations planning process and borrowing techniques used by the coordinated system; affected environment: supporting material, environment impacts of generic resource types; the system analysis model and least cost mix model; use of fishpass in analysis; the decision analysis model for aluminium industry analysis; the joint BPA-council industrial model; background on fish, wildlife, and vegetation impacts due to hydro operations; background on fish, wildlife and vegetation impacts due to fossil fuel fired plant operations; overview of Columbia basin anadromous fish stocks and significance analysis; and over-generation spill, etc. It contains compiled data.

53129 (ORNL/CON–306) **Balancing the scales: Data on electricity supply and demand resources.** Hirst, E. Oak Ridge National Lab., TN (USA). Sep 1990. 49p. Sponsored by U.S. DOE Conservation & Renewable Energy; Electric Power Research Institute. DOE Contract AC05-84OR21400. Order Number DE91000051. Source: NTIS, PC A04/MF A01 - OSTI; GPO Dep.

In the energy arena, the greatest data needs concern the costs and performance of demand-side management (DSM) programs, which are likely to grow in size and importance. It is difficult to assess the contributions that utility DSM programs could make to resolving national energy problems because comprehensive and accurate data on such programs do not exist. As debates continue over acid rain, global warming, integrated resource planning, competitive bidding to provide resources to utilities, and energy-efficiency and load-management programs, the need will increase for comprehensive and accurate information on utility DSM programs. Such programs will increase in scope and size because of concerns about environmental quality, because of the need to improve economic productivity, and because state regulatory commissions will provide financial incentives to utilities for implementation of successful DSM programs. This report discusses the data that utilities collect on the supply and delivery of electricity (i.e., the production, transmission, and distribution system) and the data collected on the DSM programs they operate. It will come as no surprise to most readers that there is a substantial imbalance between the information available on these two types of resources. 49 refs., 15 figs., 11 tabs.

53130 (ORNL/FTR–3778) **[Energy and electricity supply and demand]: Foreign trip report, September 10, 1990–September 15, 1990.** Wilbanks, T.J. Oak Ridge National Lab., TN (USA). 9 Oct 1990. 5p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE91000872. Source: NTIS, PC A01/MF A01 - OSTI; GPO Dep.

At the request of the International Atomic Energy Agency (IAEA), representing eleven international agencies which are sponsoring the 1991 Helsinki Symposium on Electricity and the Environment, I traveled to Brussels to participate in the second meeting of one of four advisory groups established to prepare for the Symposium. At the meeting, I was involved in a review of a draft issue paper being prepared for the Symposium and of the Symposium program.

53131 (ORNL/TM–11567) **Mid-term evaluation of the NRECA [National Rural Electric Cooperative Association] Central America Rural Electrification Support Program (CARES).** Perlack, R.D. (Oak Ridge National Lab., TN (USA)); Jones, H.G.; Garcia, A. III; Flores, E. Oak Ridge National Lab., TN (USA). Sep 1990. 40p. Sponsored by US Agency for International Development. DOE Contract AC05-84OR21400. Order Number DE91001015. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Oak Ridge National Laboratory was requested by the Regional Office for Central America and Panama to conduct a mid-term evaluation of the Cares Project, which is being implemented by the National Rural Electric Cooperative Association. This evaluation was conducted over a three week period by a four person team. Overall, the project has had numerous successes and is highly valued by local counterpart utilities and USAID Missions. Notwithstanding the significant results of the project, changes can be made in certain operating procedures and in the direction of some programmatic activities that can lead to an even more effective project.

53132 (PNL–7378) **System Demand-Side Management: Regional results.** Englin, J.E.; Sands, R.D.; De Steese, J.G.; Marsh, S.J. Pacific Northwest Lab., Richland, WA (USA). May 1990. 66p. Sponsored by U.S. DOE Office of Administration and Human Resource Management. DOE Contract AC06-76RL01830. Order Number DE91001292. Source: NTIS, PC A04/MF A01 - OSTI; GPO Dep.

To improve the Bonneville Power Administration's (Bonneville's) ability to analyze the value and impacts of demand-side programs, Pacific Northwest Laboratory (PNL) developed and implemented the System Demand-Side Management (SDSM) model, a microcomputer-based model of the Pacific Northwest Public Power system. This document outlines the development and application of the SDSM model, which is an hourly model. Hourly analysis makes it possible to examine the change in marginal revenues and marginal costs that accrue from the movement of energy consumption from daytime to nighttime. It also allows a more insightful analysis of programs such as water heater control in the context of hydroelectric-based generation system. 7 refs., 10 figs., 10 tabs.

2980 Consumption and Utilization

Refer also to citation(s) 53120, 53127, 53142

2990 Unconventional Sources and Power Generation

Refer also to citation(s) 52907, 52926, 52942

30 DIRECT ENERGY CONVERSION

3001 MHD Generators

Refer also to citation(s) 54386, 54387

53133 (AD-A-224508/2/XAB) **Electrical characteristics of a seawater MHD thruster. Final report.** Tempelmeyer, K.E. David Taylor Research Center, Bethesda, MD (USA). Jun 1990. 49p. (DTRC-90/017). Source: NTIS, PC A03/MF A01.

There is renewed interest in the application of the magnetohydrodynamic (MHD) propulsion concept to marine propulsion. However, there is almost no experimental information concerning the major physical processes which will occur in a seawater MHD propulsion unit, such as (1) the seawater electrolysis process at operational conditions needed for ship propulsion, (2) the effects of bubble formation on the performance of a seawater thruster and (3) the effectiveness of the MHD interaction in seawater. Small scale tests of an MHD type channel but without an applied magnetic field have been carried out to provide information about the first two of these areas (1) seawater electrolysis and (2) the effect of the H2 bubbles generated during the electrolysis of seawater. Current/voltage characteristics were obtained with different electrode materials for current densities up to 0.3 amp/sq cm. The effect of bubble formation on the channel current has been assessed over a range of operating conditions. Long-duration tests to 100 hrs have been made to provide information on electrode durability and long-term operational problems.

53134 (CONF-9003144-) **Second international workshop on fossil fuel fired MHD retrofit of existing power stations, Bologna, March 21-23, 1990.** Bologna Univ. (Italy). 1990. 262p. From 2. international workshop on fossil fuel fired MHD retrofit of existing power stations; Bologna (Italy); 21-23 Mar 1990. Order Number DE91712706. Source: NTIS (US Sales Only), PC A12/MF A01.

The topics dealt with at this second international MHD retrofit workshop were the following: research work being conducted at the major test facilities (e.g., at the Univ. of Tennessee Space Inst., MHD Generator U-25 facility in the USSR), MHD conceptual design feasibility studies, MHD retrofit economics, disk generator applications, plasma diagnostics, MHD channel mathematical models, bottoming and topping cycle efficiencies, test plant scale up, superconducting magnet applications and world-wide commercialization efforts.

3002 EHD Generators

Refer also to citation(s) 53134

3005 Fuel Cells

Refer also to citation(s) 52949, 53966, 53973

53135 (AD-A-223964/8/XAB) **Lightweight solid-polymer-electrolyte fuel cell with stack power density of 3 kW/lb (7kW/kg). Interim report, January-March 1990.** Swan, D.H.; Parthasarathy, A.; Velev, O.; Srinivasan, S.; Martin, C.R. Texas A and M Univ., College Station, TX (USA). Dept. of Chemistry. 6 Jul 1990. 22p. Contract N00014-88-K-0389. (RF-6035). Source: NTIS, PC A03/MF A01.

In this reporting period data for the physiochemical properties of the Pt/Solid polymer electrolyte interface were obtained using cyclic voltammetry and potential pulse techniques. The oxygen diffusion coefficient in Nafion was determined to be 7.4 10-7cm2.s. Several single cells were assembled and their performance at different current densities tested. The maximum power density achieved was 1.4W/cm2 with a 50 microns thick membrane and electrodes with high Pt loading at 90 C and pressure of 5atm. A design for a fuel cell stack is proposed meeting the requirements for 7W/kg specific power density. The current collectors are from gold plated titanium. High flow rate of oxygen will be used in order to achieve high heat transfer rate between the stack and the gas flow as well aS removal of the product water.

53136 (PB-90-260522/XAB) **Intermediate-temperature oxygen-conducting solid electrolytes and mixed conductors. Annual report No. 2 (September 1, 1988-August 31, 1989). Technical report.** Guer, T.M.; Wise, H.; Huggins, R.A. Stanford Univ., CA (USA). Dept. of Materials Science and Engineering. Sep 1989. 24p. Contract GRI-5087-260-1534. (MS-1115). Source: NTIS, PC A03/MF A01.

The report describes results from three different areas of emphasis during the second year of the program. The first part of the report deals with the results of work on the partial oxidation of methane to produce useful chemicals using a solid state electrochemical reactor. The second part describes efforts toward the development, synthesis and characterization of intermediate temperature oxygen-conducting solid electrolytes that might be employed in a novel monolithic solid state electrochemical configuration. Such configurations might be interesting for fuel cell, electrochemical oxygen separation and solid electrolyte enhanced catalysis applications. This work comprised the largest portion of the total effort expended during this year. The last part of the report deals with the design and development of an experimental arrangement and a solid state ionic technique to characterize oxygen ionic transport in mixed conducting perovskite-based oxides under concentration gradients. These perovskites are very interesting and important because they may be used as electrode materials in high temperature fuel cells or as non-porous solid membranes for chemically driven oxygen separation applications.

53137 **The behavior of electrochemical cell resistance: A possible application to cold fusion experiments.** Ritley, K.A. (Brookhaven National Lab., Upton, NY (USA)); Dull, P.M.; Weber, M.H.; Carroll, M.; Hurst, J.J.; Lynn, K.G. *Fusion Technology (USA)*, 17(4): 699-703 (Jul 1990).

Knowledge of the basic electrochemical behavior found in typical cold fusion experiments is important to understanding and preventing experimental errors. For a Pd/LiOH(D)/Pt electrochemical cell, the applied cell voltage/current relationship (the effective cell resistance) does not obey Ohm's law directly, but instead exhibits a complicated response to the current, voltage, temperature, electrolyte conductance, and other factors. Failure to properly consider this response can possibly result in errors that could affect the heat balance in calorimetry and temperature measurement experiments. Measurements of this response under varying voltage, temperature, and electrolyte conductivity conditions are reported. A plausible scenario in which the temperature dependence of the effective cell resistance can either exaggerate or ameliorate novel exothermic processes is suggested.

53138 **Internal reforming development for solid oxide fuel cells.** Lee, A.L. (Institute of Gas Technology, Chicago, IL (USA)); Zubransky, R.F.; Huber, W.J. *Industrial and Engineering Chemistry Research (USA)*, 29(5): 766-773 (May 1990).

Internal reforming of natural gas within a solid oxide fuel cell (SOFC) is expected to make it a more efficient system for the production of electrical power. Nickel-zirconia cermets are prime candidate material for use as the anode in an SOFC. This paper reports four procedures used to prepare 16 nickel-zirconia cermets: tape casting, slurry, incorporation of pore formers, and granulation. The resultant cermets had nickel contents from 50% to 80%,porosities from 14% to 66%, and mean pore sizes of 0.25-1.8 μm. The catalytic behavior of two cermets was determined in a continuously stirred tank reactor at atmospheric pressure over a temperature range of 800-1000°C and steam-to-hydrocarbon ratios of 2-8 mol/mol using pure methane as the feed. The data support the reaction being first order with respect to methane and -1.25 for steam.

53139 **Electrochemical evaluation of bis(trifluoromethylsulfonyl) methane as a fuel cell electrolyte.** Saffarian, H. (Materials and Chemical Sciences Div., Lawrence Berkeley Lab., Berkeley, CA (US)); Ross, P.; Behr, F.E.; Gard,

G.L. *Journal of the Electrochemical Society (USA)*, 137(5): 1345-1347 (May 1990).

This paper reports the kinetics of oxygen reduction on Pt studied in a new type of perfluorinated acid, $(CF_3SO_2)_2CH_2$ [bis(trifluoromethylsulfonyl)methane], containing acidic C–H bonds. This acid appears to be the strongest carbene acid known. At 90°C, the conductivity of 1.15 *M* $(CF_3SO_2)_2CH_2$ is 0.6 Ω^{-1} cm^{-1}, which is the same as that of 98% phosphoric acid at 170°C. Even the room temperature conductivity of this acid is higher than that of 85% phosphoric acid at 100°C. Kinetic measurements were made using the rotating disk electrode technique in *p*H = 1 solutions and with porous fuel cell electrodes in solutions at the limit of solubility (1.15 *M*). At *p*H = 1, the half-wave potential for oxygen reduction is shifted cathodically by 115 mV relative to that for phosphoric acid at the same *p*H, representing an approximately one order of magnitude increase in rate. Using standard fuel cell electrodes, the room temperature polarization in 1.15 *M* $(CF_3SO_2)_2CH_2$ was 40–60 mV lower than with the same electrodes used in 85% phosphoric acid at 70°C.

53140 **Solid oxide fuel cell martix and modules.** Riley, B. To Dept. of Energy, Washington, DC (USA). USA Patent 4,943,494/A/. 24 Jul 1990. Filed date 22 Apr 1988. USA Patent patents application 7-184,918. Int. Cl. H01M 8/10. 6p. Source: Patent and Trademark Office, Box 9, Washington, DC 20232 (USA).

This patent describes porous refractory ceramic blocks arranged in an abutting, stacked configuration and forming a three dimensional array which provide a support structure and coupling means for plurality of solid oxide fuel cells (SOFCs). Each of the blocks includes a square center channel which forms a vertical shaft when the blocks are arranged in a stacked array. Positioned within the channel is a SOFC unit cell such that a plurality of such SOFC units disposed within a vertical shaft from a string of SOFC units coupled in series.

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53141 (AFME–09-1145) **US Energy conservation: Bibliography for AFME.** Agence Francaise pour la Maitrise de l'Energie, 75 - Paris (France). 1986. 24p. (In French). Order Number DE88751892. Source: NTIS (US Sales Only), PC A02/MF A01 - OSTI.

This report is a bibliography covering energy conservation and related topics. The topics covered are as follows: conservation policy questions; energy conservation in buildings; thermal energy storage in commercial buildings; the role of electric utilities in promoting energy conservation in the USA; progress in the dynamic pricing of electricity; energy efficiency of American home appliances; third party financing of energy conservation in the United States; industrial cogeneration.

53142 (DOE/BP/35738–2) **Manufactured homes simulated thermal analysis and cost effectiveness study.** Baylon, D. (Ecotope, Inc., Seattle, WA (USA)); Davis, B.; Kennedy, M.; Lubliner, M. Ecotope, Inc., Seattle, WA (USA); Washington State Energy Office, Olympia, WA (USA). 17 May 1990. 62p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AM79-87BP35738. Order Number DE91000205. Source: NTIS, PC A04/MF A01 - OSTI; GPO Dep.

In 1988 and 1989, 150 manufactured homes were built to comply with Super Good Cents (SGC) specifications adapted from the existing specifications for site-built homes under the Residential Construction Demonstration Project (RCDP). Engineering calculations and computer simulations were used to estimate the effects of the SGC specifications on the thermal performance of the homes. These results were compared with consumer costs to establish the cost-effectiveness of individual measures. Heat loss U-factors for windows, walls, floors and ceilings were established using the standard ASHRAE parallel heat flow method. Adjustments resulted in higher U-factors for ceilings and floors than assumed at the time the homes were approved as meeting the SGC specifications. Except for those homes which included heat pumps, most of the homes did not meet the SGC compliance standards. Nonetheless these homes achieved substantial reductions in overall heat loss rate (UA) compared to UAs estimated for the same homes using the standard insulation packages provided by the manufacturers in the absence of the RCDP program. Homes with conventional electric furnaces showed a 35% reduction in total UA while homes with heat pumps had a 25% reduction. A regression analysis showed no significant relationship between climate zone, manufacturer and UA. A modified version of SUNDAY building simulation program which simulates duct and heat pump performance was used to model the thermal performance of each RCDP home as built and the same home as it would have been built without SGC specifications (base case). Standard assumptions were used for thermostat setpoint, thermal mass, internal gains and infiltration rates. 11 refs., 5 figs., 5 tabs.

53143 (DOE/BP/64352–1) **Ventilation measurements in energy-efficient multifamily dwelling units in the Pacific Northwest Region.** Parker, G.B. Pacific Northwest Lab., Richland, WA (USA). Mar 1990. 122p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AI79-86BP64352. Order Number DE91000806. Source: NTIS, PC A06/MF A01 - OSTI; GPO Dep.

A ventilation field measurement study was conducted during the 1986/1987 and 1987/1988 heating seasons in 39 energy-efficient multifamily dwelling units. Four buildings, two in eastern Washington and two in western Washington, were involved in the study. The purpose of the study was to determine the total and baseline (natural) air exchange rates in units representing energy-efficient construction in the multifamily sector of the Pacific Northwest. This information will be used to aid in the development of future construction codes and standards. The air exchange rate was measured a multiple perfluorocarbon tracer (PFT) technique. Most measurements were taken over a 2- to 4-week period, with a few measurements taken over a period of one to three consecutive months. The PFT technique allows one to determine the fresh air flow into any unit within a building as well as the air flow between adjacent units. In addition, the volumetric air flow and usage of the mechanical ventilation system installed in the units were measured. Temperature, weather, structure, and occupancy data were also collected. 12 refs., 19 figs., 14 tabs.

53144 (DOE/BP/95951–1) **Japanese refrigerators: A field performance analysis: Summary report.** Short, J.A. Lambert Engineering, Inc., Bend, OR (USA). Feb 1990. 6p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AP79-89BP95951. Order Number DE91000157. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Society generally expects Japanese refrigerators to be more energy efficient than their American-made counterparts. With increasing attention being focused on appliance energy efficiency, research into operating characteristics of Japanese refrigerators has gained importance. Other projects report the monitored energy use of certain models of Japanese refrigerators. In addition, laboratory tests determined energy consumption of certain refrigerators under controlled conditions. In 1987, Bonneville Power Administration (BPA) undertook a project to measure and analyze the energy consumption of 12 Japanese-made refrigerators in the Portland-Vancouver metropolitan area. This project's purpose was to collect field data on certain models and compare with that collected in other projects and laboratory tests. Japanese energy consumption figures fall 30–40% below those of DOE. This energy savings, if real, could substantially cut baseload power for utilities. Determining typical refrigerator energy use patterns and which environmental factors effect them helps utilities to forecast demand. 7 refs., 1 fig., 1 tab.

53145 (DOE/BP/95951–2) **Japanese refrigerators: A field performance analysis: Final report.** Short, J.A. Lambert Engineering, Inc., Bend, OR (USA). Feb 1990. 38p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AP79-89BP95951. Order Number DE91000158. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The Pacific Northwest Electric Power Planning and Conservation Act, signed into law December 5, 1980, mandated regionwide energy conservation practices. Under the Act, BPA must identify and implement cost-effective electric energy options and programs for the Pacific Northwest. The Residential Technology Section in the Division of Resource Management supports current residential energy conservation programs and designs and conducts various research and development projects, of which this project is one. Laboratory test procedures used by the Japanese had shown their refrigerators to be about 50 percent more efficient than American-made refrigerators. A previous BPA study tested 12 Japanese refrigerators according to the USDOE laboratory procedure. When tested to the DOE procedure, Japanese refrigerators used about 43 percent more energy than when tested by the Japanese procedure. This study compared in-home energy use of 12 Japanese refrigerators identical to those in the laboratory test to both the Japanese and USDOE laboratory tests. 7 refs., 9 tabs.

53146 (DOE/BP/95951–3) **Japanese refrigerators: A field performance analysis: Field data inspection, screening and compilation.** Nelson, P.E. Lambert Engineering, Inc., Bend, OR (USA). Nov 1989. 27p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AP79-89BP95951. Order Number DE91000159. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The Pacific Northwest Electric Power Planning and Conservation Act, signed into law December 5, 1980, mandated regionwide energy conservation practices. Under the act, BPA must identify and implement cost-effective electric energy options and programs for the Pacific Northwest. The Residential Technology Section in the Division of Resource Management supports current residential energy conservation programs and designs and conducts various research and development projects, of which this project is one. Laboratory test procedures used by the Japanese had shown their refrigerators to be about 50 percent more efficient than American-made refrigerators. A previous BPA study tested 12 Japanese refrigerators according to the USDOE laboratory procedure. This study showed that when tested to the DOE procedure, the Japanese refrigerators used about 43 percent more energy than when tested by the Japanese procedure. This study compared in-home energy use of 12 Japanese refrigerators identical to those in the laboratory test to both the Japanese and USDOE laboratory tests. 2 figs., 3 tabs.

53147 (EPRI-CU–6952) **Residential energy usage comparison project: An overview.** Smith, B.A. (Quantum Consulting, Inc., Berkeley, CA (USA)); Uhlaner, R.T.; Cason, T.N. Electric Power Research Inst., Palo Alto, CA (USA); Quantum Consulting, Inc., Berkeley, CA (USA). ©Oct 1990. 52p. Sponsored by Electric Power Research Institute. Source: Research Reports Center, Box 50490, Palo Alto, CA 94303.

This report provides an overveiw of the residential energy usage comparison project, an integrated load and market research project sponsored by EPRI and the Southern California Edison Company. Traditional studies of the relative energy consumption of electric and gas household appliances have relied on laboratory analyses and computer simulations. This project was designed to study the appliance energy consumption patterns of actual households. Ninety-two households in Orange County, California, southeast of Los Angeles, served as the study sample. Half of the households received new electric space-conditioning, water-heating, cooking, and clothes-drying equipment; the other half received gas equipment. The electric space-conditioning and water-heating appliances were heat pump technologies. All of the appliances were metered to collect load-shape and energy consumption data. The households were also surveyed periodically to obtain information on their energy needs and their acceptance of the appliances. The metered energy consumption data provide an important benchmark for comparing the energy consumption and costs of alternative end-use technologies. The customer research results provide new insights into customer preferences for fuel and appliance types. 15 figs., 3 tabs.

53148 (NYSERDA–90-8) **Lessons Learned: A review of utility experience with conservation and load management programs for commercial and industrial customers: Final report.** Nadel, S. American Council for an Energy-Efficient Economy, Washington, DC (USA). Oct 1990. 351p. Sponsored by New York State Energy Research and Development Authority. Source: OSTI, PO Box 62, Oak Ridge, TN 37831; OSTI; New York State Energy Research and Development Authority, Two Rockefeller Plaza, Albany, NY 12223.

This report examines utility experience with conservation and load management (C&LM) programs of commercial and industrial (C&I) customers in order to summarize the lessons learned from program experiences to date and what these teach us about how to operate successful programs in the future. This analysis was motivated by a desire to learn about programs which achieve high participation rates and high electricity savings while remaining cost effective. Also, we wanted to review the very latest experiences with innovative program approaches – approaches that might prove useful to utilities as they scale up their C&LM activities. Specific objectives of this phase of the study are threefold: (1) To disseminate information on utility C&LM experience to a nationwide audience. (2) To review current New York State utility programs and make suggestions on how these programs can be improved. (3) To collect data for the final phase of the American Council for an Energy-Efficient Economy/New York State Energy Research and Development Authority project, which will examine the savings that are achievable if C&LM programs are "pushed to the limit" of current knowledge on how to structure and run cost-effective C&LM programs. 19 tabs.

53149 (NYSERDA–90-11) **An investigation of infiltration and indoor air quality: Final report.** New York State Energy Research and Development Authority, Albany, NY (USA); Research Triangle Inst., Research Triangle Park, NC (USA). Sep 1990. 436p. Sponsored by New York State Energy Research and Development Authority. Source: OSTI; New York State Energy Research and Development Authority, Two Rockefeller Plaza, Albany, NY 12223.

A multitask study was performed in the State of New York to provide information for guiding home energy conservation programs while maintaining acceptable indoor air quality. During this study, the statistical distribution of radon concentrations inside 2400 homes was determined. The relationships among radon levels, house characteristics, and sources were also investigated. The direct impact that two specific air infiltration reduction measures – caulking and weatherstripping of windows and doors, and installation of storm windows and storm doors – have on house air leakage was investigated in 60 homes. The effect of house age on the impact of weatherization was also evaluated. Indoor and outdoor measurements of NO_2, CO, SO_2, and respirable suspended particulates (RSP) were made for 400 homes to determine the effect of combustion sources on indoor air quality and to characterize the statistical distribution of the concentrations. Finally, the combustion source data were combined with the information on air infiltration reduction measures to estimate the potential impact of these measures on indoor air quality. 87 tabs.

53150 (ORNL/M–1245) **Building Thermal Envelope Systems and Materials (BTESM) and research utilization/technology transfer: Monthly progress report for DOE [Department of Energy] Office of Buildings Energy Research, July 1990.** Burn, G. (comp.). Oak Ridge National Lab., TN (USA). Jul 1990. 30p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC05-84OR21400. Order Number DE91000536. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The Monthly Report of the Building Thermal Envelope Systems and Materials (BTESM) Programs is a monthly update of both in-house ORNL projects and subcontract activities in the research areas of building materials, wall systems, foundations, roofs, building diagnostics, and research utilization and technology transfer. Presentations are not stand-alone paragraphs every month. Their principal values are the short-time lapse between accomplishment and reporting and their evolution over a period of several months..

53151 (ORNL/M–1267) **Building Thermal Envelope Systems and Materials (BTESM) and research utilization/technology transfer progress report for DOE [Department of Energy] Office of Buildings Energy Research: Monthly progress report.** Burn, G. (comp.). Oak Ridge National Lab., TN (USA). Aug 1990.

66p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC05-84OR21400. Order Number DE91000541. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The Monthly Report of the Building Thermal Envelope Systems and Materials (BTESM) Program is a monthly update of both in-house ORNL projects and subcontract activities in the research areas of building materials, wall systems, foundations, roofs, building diagnostics, and research utilization and technology transfer. Presentations are not stand-alone paragraphs every month. Their principal values are the short-time lapse between accomplishment and reporting and their evolution over a period of several months.

53152 (ORNL/TM–11339) **The North Carolina Field Test: Experimental plan.** Sharp, T.R.; Ternes, M.P. Oak Ridge National Lab., TN (USA). Aug 1990. 71p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC05-84OR21400. Order Number DE91001009. Source: NTIS, PC A05/MF A01 - OSTI; GPO Dep.

The North Carolina Field Test will test the effectiveness of two weatherization approaches: the current North Carolina Low-Income Weatherization Assistance Program and the North Carolina Field Test Audit. The Field Test Audit will differ from North Carolina's current weatherization program in that it will incorporate new weatherization measures and techniques, a procedure for basing measure selection of the characteristics of the individual house and the cost-effectiveness of the measure, and also emphasize cooling energy savings. The field test will determine the differences of the two weatherization approaches from the viewpoints of energy savings, cost effectiveness, and implementation ease. This Experimental Plan details the steps in performing the field test. The field test will be a group effort by several participating organizations. Pre- and post-weatherization data will be collected over a two-year period (November 1989 through August 1991). The 120 houses included in the test will be divided into a control group and two treatment groups (one for each weatherization procedure) of 40 houses each. Weekly energy use data will be collected for each house representing whole-house electric, space heating and cooling, and water heating energy uses. Corresponding outdoor weather and house indoor temperature data will also be collected. The energy savings of each house will be determined using linear-regression based models. To account for variations between the pre- and post-weatherization periods, house energy savings will be normalized for differences in outdoor weather conditions and indoor temperatures. Differences between the average energy savings of treatment groups will be identified using an analysis of variance approach. Differences between energy savings will be quantified using multiple comparison techniques. 9 refs., 8 figs., 5 tabs.

53153 (ORNL/TM–11602) **Energy efficiency in nonprofit agencies: Creating effective program models.** Brown, M.A.; Prindle, B.; Scherr, M.I.; White, D.L. Oak Ridge National Lab., TN (USA). Aug 1990. 82p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC05-84OR21400. Order Number DE91000538. Source: NTIS, PC A05/MF A01 - OSTI; GPO Dep.

Nonprofit agencies are a critical component of the health and human services system in the US. It has been clearly demonstrated by programs that offer energy efficiency services to nonprofits that, with minimal investment, they can educe their energy consumption by ten to thirty percent. This energy conservation potential motivated the Department of Energy and Oak Ridge National Laboratory to conceive a project to help states develop energy efficiency programs for nonprofits. The purpose of the project was two-fold: (1) to analyze existing programs to determine which design and delivery mechanisms are particularly effective, and (2) to create model programs for states to follow in tailoring their own plans for helping nonprofits with energy efficiency programs. Twelve existing programs were reviewed, and three model programs were devised and put into operation. The model programs provide various forms of financial assistance to nonprofits and serve as a source of information on energy efficiency as well. After examining the results from the model programs (which are still ongoing) and from the existing programs, several "replicability factors" were developed for use in the implementation of programs by other states. These factors – some concrete and practical, others more generalized – serve as guidelines for states devising program based on their own particular needs and resources.

53154 (PB–90-260530/XAB) **Fundamental research on porous-glass desiccants. Annual report, May 1989-April 1990.** Mullins, M.E.; Cornilsen, B.C. Michigan Technological Univ., Houghton, MI (USA). Jun 1990. 75p. Contract GRI-4089-2560-1780. Source: NTIS, PC A04/MF A01.

The objective of the research is to study the fundamental chemistry of sol-gel derived porous glass desiccants and the effects of processing on the final water sorption characteristics. The goal is to produce advanced desiccant materials meeting the criteria required for desiccant cooling systems. Desiccant processes for dehumidifying and cooling are promising gas-fired air conditioning options. During the first year, work has concentrated on the formulation of two phase materials, alumino-silicates and boro-silicates, and their processing. Variations in the formulations tested for the glasses include metal ratios, water-ethanol ratios, as well as catalyst type and dosage. In the area of processing, work has been concentrated on the sequencing of reactant and catalyst addition, as well as drying of the product gels. Two-step addition of catalyst appears to be the best method to control the final product characteristics. Technical validation of these formulations and processing approaches has been obtained from spectroscopic studies. The effect of drying on the gel products to their final glass form has been investigated for three techniques - conventional drying, vacuum drying, and microwave drying - with each technique imparting different properties to the glass. The water adsorption properties of the product glasses have been examined and isotherm measurements were made.

53155 (PNL–7299-Vol.2) **Development of a methodology for defining whole-building energy design targets for commercial buildings: Phase 2, Development concept stage report: Volume 2, Technical concept development task reports.** McKay, H.N. (Illuminating Engineering Society of North America, New York, NY (USA)); Deringer, J.J.; Jones, J.W.; Hall, J.D. Pacific Northwest Lab., Richland, WA (USA); American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., Atlanta, GA (USA). Sep 1990. 278p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC06-76RL01830. Order Number DE91001034. Source: NTIS, PC A13/MF A01 - OSTI; GPO Dep.

This report documents eight tasks performed as part of the Whole-Building Energy Design Targets project, in which detailed conceptual approaches were produced for each element of the proposed Targets model. The eight task reports together describe the important modules proposed for inclusion in the Targets model: input module, energy module, characteristic development moduel, building cost module, analysis control module, energy cost module, search routines module, and economic analysis module. 16 refs., 16 figs., 5 tabs.

53156 (PNL–7299-Vol.3) **Development of a methodology for defining whole-building energy design targets for commercial buildings: Phase 2, Development concept stage report: Volume 3, Workshop summaries.** Jones, J.W. (American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., Atlanta, GA (USA)); Deringer, J.J.; Hall, J.D. Pacific Northwest Lab., Richland, WA (USA); American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., Atlanta, GA (USA). Sep 1990. 39p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC06-76RL01830. Order Number DE91001032. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The Whole-Building Energy Design Targets project is being conducted for the US Department of Energy (DOE) by the Pacific Northwest Laboratory (PNL). The objective of the project is to develop a flexible methodology for setting energy performance guidelines with which architects, engineers, planners, and owners can assess energy efficiency in commercial building design. This volume, the third in the four-volume report on the Targets project concept stage, contains the minutes of the workshops as well as summaries of the expert's written comments prepared at the close of each workshop. In Section 2, the building energy simulation workshop is summarized. Section 3 provides a summary of the building cost workshop.

53157 (SERI/TP–260-3881) **A planning framework for transferring building energy technologies: Executive summary.** Farhar, B.C.; Brown, M.A.; Mohler, B.L.; Wilde, M.; Abel, F.H. Solar Energy Research Inst., Golden, CO (USA). Aug 1990. 11p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC02-83CH10093. Order Number DE90000369. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Accelerating the adoption of new and existing cost-effective technologies has significant potential to reduce the energy consumed in US buildings. This report summarizes some of the key results of an interlaboratory technology transfer planning effort in support of the US Department of Energy's Office of Building Technologies (the full report is published under SERI number TP-260-3729). A guiding assumption for planning was that OBT's R&D program should forge linkages with existing programs whose goals involved enhancing energy efficiency in buildings. An ad hoc Technology Transfer Advisory Group reviewed the existing analysis and technology transfer program, brainstormed technology transfer approaches, interviewed DOE program managers, identified applicable research results, and developed a framework that management could use in deciding on the best investments of technology transfer resources. Representatives of 22 organizations were interviewed on their views of the potential for transferring energy efficiency technologies through active linking with OBT. The report describes in summary these programs and interview results; outlines OBT tools, technologies, and practices to be transferred; defines OBT audiences; identifies technology transfer functions and presents a framework devised using functions and audiences; presents some example technology transfer activities; and summarizes the Advisory Group's recommendations.

53158 (VTT-TIED–1126) **Winter city block of the housing fair at Ispoinen, Turku.** Rauhala, K. (Valtion Teknillinen Tutkimuskeskus, Espoo (Finland). Yhdyskunta- ja rakennussuunnittelun Laboratorio). Valtion Teknillinen Tutkimuskeskus, Espoo (Finland). May 1990. 42p. (In Finnish). Order Number DE91707469. Source: NTIS (US Sales Only), PC A03/MF A01.

As a part of the monitoring research concerning a winter city block, a special winter city survey was organized in connection with the Turku Housing Fair. The survey was carried out over one week in June 1988 in the Jaeaekukka house. The number of accepted responses rose to 181. On an average, the respondents were 35 years old, mostly men, white-collar workers and living in privately financed dwellings. According to the results, glazed balconies, glazed-over common spaces and sheltered gallery accesses were considered to be useful extra solutions. The most favoured solution for the respondents proved to be glazed balconies. Glazed-over common spaces, the most typical means of enhancing social life and activities during the dark winter months, received the strongest support from young people, the unsalaried (full-time mothers, pensioners and unemployed people) as well as tenants and those living in sparsely polulated areas. The willingness to pay over the normal price for winter city amenities was also apparent. On the other hand, people were ready to compromise over other facilities in order to benefit from winter city solutions. Well-to-do people, those living in owner-occupied flats and in small houses were most inclined to pay for novel solutions. They were also most reluctant to reduce the housing standard elsewhere for economizing. Correspondingly, people of a lower standard of living, the unsalaried, those living in rented accommodation and in blocks of flats showed the least willingness to pay extra and accordingly the greatest readiness to compromise. The research will continue with a monitoring phase of over a period of 1 to 2 years covering the attitudes of the actual inhabitants of the Jaeaekukka house towards winter city solutions.

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Refer also to citation(s) 52762, 53114, 53187

53159 (CONF-900801–34) **Commercial aircraft fuel efficiency potential through 2010.** Greene, D.L. Oak Ridge National Lab., TN (USA). [1990]. 7p. Sponsored by U.S. DOE Office of Policy, Planning and Analysis. DOE Contract AC05-84OR21400. From 25. intersociety energy conversion engineering conference; Reno, NV (USA); 12-17 Aug 1990. Order Number DE91000720. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Aircraft are second only to motor vehicles in the use of motor fuels, and air travel is growing twice as fast. Since 1970 air travel has more than tripled, but the growth of fuel use has been restrained by a near doubling of efficiency, from 26.2 seat miles per gallon (SMPG) in 1970 to about 49 SMPG in 1989. This paper explores the potential for future efficiency improvements via the replacement of existing aircraft with "1990's generation" and "post 2000" aircraft incorporating advances in engine and airframe technology. Today, new commercial passenger aircraft deliver 50–70 SMPG. New aircraft types scheduled for delivery in the early 1990's are expected to achieve 65–80 SMPG. Industry and government researchers have identified technologies capable of boosting aircraft efficiencies to the 100–150 SMPG range. Under current industry plans, which do not include a post-2000 generation of new aircraft, the total aircraft fleet should reach the vicinity of 65 SMPG by 2010. A new generation of 100–150 SMPG aircraft introduced in 2005 could raise the fleet average efficiency to 75–80 SMPG in 2010. In any case, fuel use will likely continue to grow at from 1–2%/yr. through 2010. 20 refs., 2 figs., 2 tabs.

53160 (CONF-9006105–11) **Performance analysis of seawater magnetohydrodynamics (MHD) thruster propulsion systems within a test loop.** Bouillard, J.X. (Argonne National Lab., IL (USA)); Berry, G.F.; Pierson, E.S. Argonne National Lab., IL (USA). [1990]. 18p. Sponsored by U.S. Department of Defense. DOE Contract W-31109-ENG-38. From 28. symposium on engineering aspects of magnetohydrodynamics; Chicago, IL (USA); 26-28 Jun 1990. Order Number DE90017827. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The recent dramatic development in high temperatures superconducting materials and the successful operation of large and sophisticated magnet systems make it desirable to further develop the MHD seawater propulsion technology for ships. This technology would offer a new alternative to noise reduction and increase reliability improvement for presently available advanced propulsion systems. These MHD systems would offer high speed and silent operation. A candidate test loop in which seawater is self-propulsed by MHD thrust is investigated and studied using a first order and three-dimensional analyses. Increase of skin friction coefficients due to Hartmann effects are investigated. A preliminary analysis of end effects indicates that these effects may be significant at low load factors. 11 refs., 9 figs.

53161 (ORNL/TM–11489) **Ceramic Technology for Advanced Heat Engines Project: Semiannual progress report, April 1989–September 1989.** Oak Ridge National Lab., TN (USA). Aug 1990. 518p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC05-84OR21400. Order Number DE91001004. Source: NTIS, PC A21/MF A01 - OSTI; GPO Dep.

The Ceramic Technology For Advanced Heat Engines Project was developed by the Department of Energy's Office of Transportation Systems (OTS) in Conservation and Renewable Energy. This project, part of the OTS's Advanced Materials Development Program, was developed to meet the ceramic technology requirements of the OTS's automotive technology programs. Significant accomplishments in fabricating ceramic components for the Department of Energy (DOE), National Aeronautics and Space Administration (NASA), and Department of Defense (DOD) advanced heat engine programs have provided evidence that the operation of ceramic parts in high-temperature engine environments is feasible. However, these programs have also demonstrated that additional research is needed in materials and processing development, design methodology, and data base and life prediction before industry will have a sufficient technology base from which to produce reliable cost-effective ceramic engine components commercially. An assessment of needs was completed, and a five year project plan was developed with extensive input from private industry. The objective of the project is to develop the industrial technology base required for reliable ceramics for application in advanced automotive heat engines. The project approach includes determining the mechanisms controlling reliability, improving processes for fabricating existing ceramics, developing new materials with increased

reliability, and testing these materials in simulated engine environments to confirm reliability. Although this is a generic materials project, the focus is on structural ceramics for advanced gas turbine and diesel engines, ceramic hearings and attachments, and ceramic coatings for thermal barrier and wear applications in these engines.

53162 (ORNL/TM–11596) **User Interface in ORACLE for the Worldwide Household Goods Information System for Transportation Modernization (WHIST-MOD).** James, T. (Tennessee Univ., Knoxville, TN (USA)); Loftis, J. Oak Ridge National Lab., TN (USA). Jul 1990. 27p. Sponsored by U.S. Department of Defense. DOE Contract AC05-84OR21400. Order Number DE91001016. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The Directorate of Personal Property of the Military Traffic Management Command (MTMC) requested that Oak Ridge National laboratory (ORNL) design a prototype decision support system, the Worldwide Household Goods Information System for Transportation Modernization (WHIST-MOD). This decision support system will automate current tasks and provide analysis tools for evaluating the Personal Property Program, predicting impacts to the program, and planning modifications to the program to meet the evolving needs of military service members and the transportation industry. The system designed by ORNL consists of three application modules: system dictionary applications, data acquisition and administration applications, and user applications. The development of the user applications module is divided into two phases. Round 1 is the data selection front-end interface, and Round 2 is the output or back-end interface. This report describes the prototyped front-end interface for the user application module. It discusses user requirements and the prototype design. The information contained in this report is the product of in-depth interviews with MTMC staff, prototype meetings with the users, and the research and design work conducted at ORNL. 18 figs., 2 tabs.

53163 (UCRL-JC–103946) **Securing America's access to space.** Rendine, M.; Wood, L. Lawrence Livermore National Lab., CA (USA). 23 May 1990. 13p. Sponsored by US Space Foundation. DOE Contract W-7405-ENG-48. (CONF-9005277–1: U.S. space foundation space launch forum, Colorado Springs, CO (USA), 23-25 May 1990). Order Number DE91000412. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

We review pertinent aspects of the history of the space launch capabilities of the United States and survey its present status and near-term outlook. Steps which must be taken, pitfalls which much be avoided, and a core set of National options for re-acquiring in the near term the capability to access the space environment with large payloads are discussed. We devote considerable attention to the prospect of creating an interim heavy-lift space launch vehicle of at least 100,000 pound payload-orbiting capacity to serve National needs during the next dozen years, suggesting that such a capability can be demonstrated within 5 years for less than $1 B. Such capability will apparently be essential for meeting the first-phase goals of the President's Space Exploration Initiative. Some other high-leverage aspects of securing American access to space are also noted briefly, emphasizing unconventional technological approaches of presently high promise.

3203 Industrial and Agricultural Processes

Refer also to citation(s) 52666, 52704, 52761, 52762, 52910, 52927, 53093, 53148, 53651, 53763, 53768

53164 (DOE/CH/10239–1) **Investigation and field testing of anaerobic biological treatment of pharmaceutical wastewaters.** Hydroqual, Inc., Mahwah, NJ (USA). 30 Mar 1990. 417p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract FC02-85CH10239. Order Number DE90010576. Source: NTIS, PC A18/MF A01 - OSTI; GPO Dep.

A study has been conducted that investigated and demonstrated the anaerobic biological treatment of wastewaters generated by the pharmaceuticals industry. This report presents the results of the multi-phase program and the conclusions and recommendations which have been derived from an analysis of the experimental data. The program was initiated in October 1985 and was conducted over a period of 26 months, at which point the experimental portions of the study were completed in December 1987. These can be divided to essentially three major tasks: screening assays to assess anaerobic treatability; bench-scale treatability investigations of the Merck Stonewall Plant wastewaters; and, pilot scale demonstration of anaerobic treatment. Each major element is discussed separately, addressing the design of the program (facilities), the experimental procedures, and finally the results of each task. The final section discusses the application of the technology to the pharmaceutical industry and the economic components associated with it. 2 refs., 54 figs., 35 tabs.

53165 (DOE/ID/12536–2) **Research and development of a ceramic fiber composite heat exchanger: Phase 2, Final report.** Parks, W.P. Jr. Babcock and Wilcox Co., Lynchburg, VA (USA). Research and Development Div. Sep 1989. 337p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC07-84ID12536. Order Number DE90017250. Source: NTIS, PC A15/MF A01 - OSTI; GPO Dep.

The Babcock and Wilcox Company has completed the Phase II study on the Advanced Heat Exchanger Project. Phase II addressed critical problems identified in the Phase I work. The major activity involved the development and characterization of oxide-oxide ceramic composites. Additional work included seal development and design review. Novel ceramic composite tubular materials were developed using filament winding of ceramic fibers in conjunction with sol-gel infiltration. Composites based on DuPont's PRD-166 fiber and zirconia matrices exhibited 53,000 psi strength at room temperature and 35,000 psi strength at 1100°C. Property characterization included CTE, creep, microstructure, density permeability, and porosity. Composites were tested in corrosive environments $NaCO_3$ and complex refuse combustion for up to 1000 hours with minor corrosion and no erosion. Scale-up to large tubular shapes was exhibited. Compatibility with two glass seal compositions was determined for up to 96 hours at 2000°F and 100 psia. Additional work needed to commercialize this technology was discussed. 13 refs., 60 figs., 49 tabs.

53166 (EPRI-GS–7005) **Trace element removal by iron adsorption/coprecipitation: Process design manual: Final report.** Merrill, D.T. (Brown and Caldwell, Pleasant Hill, CA (USA)); Diepolder, P.R.; Bluestein, M.; Parker, D.S. Electric Power Research Inst., Palo Alto, CA (USA); Brown and Caldwell, Pleasant Hill, CA (USA). ©Oct 1990. 253p. Sponsored by Electric Power Research Institute. Source: Research Reports Center, Box 50490, Palo Alto, CA 94303.

The iron adsorption/coprecipitation process can remove many inorganic priority pollutants to the extremely low concentrations now being required by federal and state regulatory agencies. It is a low-cost technology that can be carried out in conventional water treatment equipment. The process has removed arsenic, antimony, selenium, beryllium, cadmium, chromium, copper, lead, nickel, silver, and zinc from power plant wastewaters and other industrial waste streams. This manual describes the process, its application, and methods for evaluating potential applications. Review of this manual should enable readers to prepare conceptual designs and cost analyses. 95 refs., 56 figs., 29 tabs.

53167 (PB–90-259789/XAB) **Commercial treatment/recovery capacity data set.** ICF, Inc., Fairfax, VA (USA). May 1990. 124p. Source: NTIS, PC A06/MF A01.

See also PB–89-220545.

The commercial treatment and recovery capacity data base consists of data sets on incineration/reuse as fuel and on other treatment systems. The original data set used for the proposed rule was generated by review and engineering evaluation of TSDR survey responses, transfer of data in the questionnaires to computer data entry sheets, entering of data in a PC data base, and final consolidation of all facility capacities to arrive at national totals.

53168 (PB–90-259953/XAB) **Analysis and evaluation of light-duty engines for gas-fired cogeneration. Final report, November 1983-February 1986.** Koplow, M.D.; MacLean, M.; DiNanno, L. TECOGEN, Inc., Waltham, MA (USA). Mar 1989. 144p. Contract GRI-5083-243-0860. Source: NTIS, PC A07/MF A01.

Color illustrations reproduced in black and white.

Nine natural gas fueled, commercial 60-kW packaged cogeneration systems at eight separate sites were monitored for over a year to produce 57,000 hours of documented operation of light-duty engine and cogeneration system performance data. The results showed that the automotive spark-ignition engines converted to natural gas fuel were responsible for a minority of cogeneration system problems, and that the overall reliability and performance of cogeneration systems based on low-cost engines should be as favorable as for systems based on other prime movers.

53169 (PB–90-260548/XAB) **Development of a light commercial packaged cogeneration system. Final report, February 1986-August 1989.** Panora, R.; Vasilakis, A.; Hatch, W.; Neoh, S. TECOGEN, Inc., Waltham, MA (USA). Jan 1990. 145p. Contract GRI-5087-293-1484. (TR–6408-160-89). Source: NTIS, PC A07/MF A01.

The report documents the development of a small, natural gas powered cogeneration system for light commercial service. The developed system consists of a modified automotive derivative 4.3 liter V-6 engine driving an induction generator at 1800 rpm. The unit produces 30 kW of electrical energy and 2.2 therms of thermal energy in the form of hot water (recovered from lubrication oil, engine jacket, and exhaust gas). Also included on the package is a microprocessor-based control system, an acoustic enclosure, and a complete heat recovery package for up to two thermal loads. Connections for a third load are optional. During the second phase of the three-phase program, a laboratory prototype was fabricated and tested extensively. An electrical efficiency and overall efficiency of 26 percent and 81 percent, respectively, were demonstrated while accumulating 4000 hours of reliable operation. In a separate dynamometer setup, a similarly configured engine successfully completed 5000 hours of full-load testing. Presently, the program is in the final part of Phase III; evaluation of a field test unit. The unit is currently being installed at the California test site. The 30-kW system has been commercialized by Tecogen Inc. as a part of its line of cogeneration systems.

53170 (PNL-SA–17707) **Bench-scale reactor tests of low-temperature, catalytic gasification of wet, industrial wastes.** Elliott, D.C.; Neuenschwander, G.G.; Baker, E.G.; Butner, R.S.; Sealock, L.J. Pacific Northwest Lab., Richland, WA (USA). Apr 1990. 5p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC06-76RL01830. (CONF-900801–36: 25. intersociety energy conversion engineering conference, Reno, NV (USA), 12-17 Aug 1990). Order Number DE91001318. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Bench-scale reactor tests are under way at Pacific Northwest Laboratory to develop a low-temperature, catalytic gasification system. The system, licensed under the trade name Thermochemical Environmental Energy System (TEES®), is designed for to a wide variety of feedstocks ranging from dilute organics in water to waste sludges from food processing. The current research program is focused on the use of a continuous-feed, tubular reactor. The catalyst is nickel metal on an inert support. Typical results show that feedstocks such as solutions of 2% para-cresol or 5% and 10% lactose in water or cheese whey can be processed to >99% reduction of chemical oxygen demand (COD) at a rate of up to 2 L/hr. The estimated residence time is less than 5 min at 360°C and 3000 psig, not including 1 to 2 min required in the preheating zone of the reactor. The liquid hourly space velocity has been varied from 1.8 to 2.9 L feedstock/L catalyst/hr depending on the feedstock. The product fuel gas contains 40% to 55% methane, 35% to 50% carbon dioxide, and 5% to 10% hydrogen with as much as 2% ethane, but less than 0.1% ethylene or carbon monoxide, and small amounts of higher hydrocarbons. The byproduct water stream carries residual organics amounting to less than 500 mg/L COD. 9 refs., 1 fig., 4 tabs.

53171 (VTT-SYMP–107, pp. 261-272) **Modern recovery boilers.** Hyoety, P. (Tampella Ltd., Power Industry Division, Tampere (Finland)). Valtion Teknillinen Tutkimuskeskus, Espoo (Finland). 1989. (CONF-890668–Vol.1: Symposium on low-grade fuels, Helsinki (Finland), 12-16 Jun 1989). In *Low-grade fuels: Volume 1.* 376p. Order Number DE91707607. Source: NTIS (US Sales Only), PC A17/MF A01.

The recovery boiler uses black liquor from the pulp mill as a fuel. The fuel itself consists of wood-based material, about 42% and ash, 28%; the remaining 30% is water. The combustible material is wood-type and the heating value on the AWF basis corresponds to that of waste wood. Figure 1 shows an example of the latest recovery boiler. The volume of the boiler is large in comparison with steam boilers; it is actually about two times as large as a steam boiler with the same evaporation capacity. The recovery boiler is an expensive part of the pulp mill and all production of the pulp mill depends on its operation. Therefore, carefull attention is always paid to the design of the recovery boiler.

3206 Municipalities and Community Systems

Refer also to citation(s) 52724, 52927, 53129, 53671, 53843

53172 (CRIE-Y–90004) **On the theory of priority service: a survey.** Matsukawa, I. Central Research Inst. of Electric Power Industry, Tokyo (Japan). Jun 1990. 65p. (In Japanese). Order Number DE91715331. Source: NTIS (US Sales Only), PC A04/MF A01.

Priority service (P.S) was studied as an revolutional power charge institution. P. S is a charge institution interrupting load depending on the supply reliability selected previously by a customer based on the charge menu. It is necessary to study the P. S introduction other than the seasonal charge institution in order to promote the load leveling in an increasingly competitive environment. Since the power supplying menu is diverse, customers can select optimal supplying reliability and prices on the basis of their preference. It is required to establish the priciple of higher the quality, higher the price to execute this institution. Conventional load interrupting charge institution is dependent of separate negotiation between a customer and a power company but P.S is dependent on the selection by a customer, so that many customers can receive the service. Further, effective load allocation which is not uniform can be done. Even if the menu number is small, the effect may be large. While P. S is as an efficient rate as real-time pricing, the service enables customers to be immune from risks of price variations and outage. 83 refs., 9 figs., 8 tabs.

53173 (DOE/CE/26593–1) **Desiccant-based, heat-actuated cooling assessment for DHC [District Heating and Cooling] systems: Final report, May 1, 1989–May 31, 1990.** Patch, K.D.; DiBella, F.A.; Becker, F.E. TECOGEN, Inc., Waltham, MA (USA). Jul 1990. 49p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract FG01-89CE26593. (TR–4471-058-90). Order Number DE90015516. Source: NTIS, PC A04/MF A01 - OSTI; GPO Dep.

An assessment has been completed of the use of desiccant-based, heat-actuated cooling for District Heating and Cooling (DHC) systems, showing that such desiccant-based cooling (DBC) systems are generally applicable to District Heating (DH) systems. Since the DH system only has to supply hot water (or steam) to its customers, systems that were designed as conventional two-pipe DH systems can now be operated as DHC systems without major additional capital expense. Desiccant-based DHC systems can be operated with low-grade DH-supplied heat, at temperatures below 180°F, without significant loss in operating capacity, relative to absorption chillers. During this assessment, a systems analysis was performed, an experimental investigation was conducted, developmental requirements for commercializing DBC systems were examined, and two case studies were conducted. As a result of the case studies, it was found that the operating cost of a DBC system was competitive with or lower than the cost of purchasing DHC-supplied chilled water. However, because of the limited production volume and the current high capital costs of desiccant systems, the payback period is relatively long. In this regard, through the substitution of low-cost components specifically engineered for low-temperature DHC systems, the capital costs should be significantly reduced and overall economics made attractive to future users. 17 figs.

53174 (NEDO-P–8916) **Research on city waste energy recovery systems.** New Energy Development Organization, Tokyo (Japan). Mar 1990. 183p. (In Japanese). Order Number DE91715396. Source: NTIS (US Sales Only), PC A09/MF A01.

In order to reuse waste as energy, effective treatment system was investigated in possibility. For the purpose of waste energy recovery, has been already made technical development of incineration/electric power generation/thermal utilization, methane fermentation, and thermal cracking gasification/making oily. But due to physical and other properties of waste, thermal efficiency is lower than that in Europe and America. Moreover due to legal restriction, combined incineration can not be made with different kinds of waste, expected to be heightened in energy recovery rate and economicality. Then, two kinds of combined waste incineration power generation/thermal utilization system being assumed as a case study, the system was confirmed in usefulness, upon result of calculating its material/thermal balance and economicality. As a process, they are large city type exclusive waste incineration power generation system and large city type combined waste incineration power generation system. The former is to generate power through combined incineration with different kinds of waste, aiming at 24.4% in power generation efficiency, while the latter is to install waste incinerator, associated with coal power station, doing at 32.3% in power generation efficiency. 27 refs., 40 figs., 35 tabs.

53175 (ORNL/TM–11383) **Economic analysis of coal-fired cogeneration plants for Air Force bases.** Holcomb, R.S.; Griffin, F.P. Oak Ridge National Lab., TN (USA). Oct 1990. 79p. Sponsored by U.S. Department of Defense. DOE Contract AC05-84OR21400. Order Number DE91000539. Source: NTIS, PC A05/MF A01 - OSTI; GPO Dep.

The Defense Appropriations Act of 1986 requires the Department of Defense to use an additional 1,600,000 tons/year of coal at their US facilities by 1995 and also states that the most economical fuel should be used at each facility. In a previous study of Air Force heating plants burning gas or oil, Oak Ridge National Laboratory found that only a small fraction of this target 1,600,000 tons/year could be achieved by converting the plants where coal is economically viable. To identify projects that would use greater amounts of coal, the economic benefits of installing coal-fired cogeneration plants at 7 candidate Air Force bases were examined in this study. A life-cycle cost analysis was performed that included two types of financing (Air Force and private) and three levels of energy escalation for a total of six economic scenarios. Hill, McGuire, and Plattsburgh Air Force Bases were identified as the facilities with the best potential for coal-fired cogeneration, but the actual cost savings will depend strongly on how the projects are financed and to a lesser extent on future energy escalation rates. 10 refs., 11 figs., 27 tabs.

53176 (ORNL/TM–11406) **Segregation of metals-containing wastewater by pH.** Taylor, P.A.; McTaggart, D.R. Oak Ridge National Lab., TN (USA). Oct 1990. 14p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE91000892. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

A pH-based sampling system has shown that there is a high correlation between low pH and metals contamination for the wastewater from the 4500 area (manhole 190) and the 2000 area (pump station). Wastewater from the Radiochemical Engineering Development Center (REDC) and the High Flux Isotope Reactor (HFIR) has not shown any metals concentrations above the National Pollutant Discharge Elimination System (NPDES) permit limits for the Nonradiological Wastewater Treatment Plant (NRWTP). It is recommended that pH be used as the diversion criteria for wastewater from manhole 190 and the pump station to be sent to the metals tank of the NRWTP. Any wastewater with a pH less than 6.0 or greater than 10.0 should be sent to the metals tank. Based on the results of 29 weeks of sampling, it is expected that on the order of 36m^3/wk (9500 gal/wk) of wastewater will be diverted to the metals tank of the NRWTP. Wastewater from REDC and HFIR can be sent to the nonmetals tank, but it should be sampled periodically and analyzed by Inductively Coupled Plasma (ICP) spectrophotometer to confirm that the metals concentration is not increasing. 1 ref., 2 figs., 9 tabs.

53177 (PB–90-264029/XAB) **Waste-minimization efforts: An overview of the US EPA pollution-prevention research program.** Bridges, J.S. Environmental Protection Agency, Cincinnati, OH (USA). Risk Reduction Engineering Lab. 1990. 14p. (EPA–600/D-90/138). Source: NTIS, PC A03/MF A01.

The paper's purpose is to describe the current pollution prevention research program assigned to the Risk Reduction Engineering Laboratory which incorporated multi-media direction in providing practical solutions to the complex problems of waste management. The pollution prevention research program follows the six fundamental goals identified in the Pollution Prevention Research Plan: Report to Congress. The six research goal areas are: products, processes, recycling and reuse, socio-economics and institutions, anticipatory; and technology transfer. Municipal solid waste research is described for the source reduction and recycling projects planned and currently in progress.

53178 The U.S. Department of Energy biofuels research program. Walter, D.K. (Biofuels and Municipal Wastes Div., U.S. Dept. of Energy, Washington, DC (US)). pp. 47-62 of Energy from biomass and wastes XIII. Institute of Gas Technology, Chicago, IL (USA) (1989). pp. 1378

This paper reports how the US DOE biofuels research program has focussed and defined biofuels and municipal waste technology research to insure cooperation between the various growth and conversion elements. Researchers in the conversion areas have begun to conduct experiments with energy crops as they will be available in commercial practice. For example, ethanol research that was formerly conducted with aspen heartwood chips has been converted to whole tree short rotation poplar chips. The energy crop program has expanded from growing more mass (cellulose) per acre to add research to improve the energy conversion quality of feedstock.

3209 Education and Public Relations

Refer also to citation(s) 53153, 54182

33 ADVANCED PROPULSION SYSTEMS

Refer also to citation(s) 53243

53179 Current-driven plasma acceleration versus current-driven energy dissipation. I. Wave stability theory. Kelly, A.J. (Princeton Univ., NJ (USA)); Jahn, R.G.; Choueiri, E.Y. 20p. Princeton Univ., Princeton, NJ (US) (1990). (AIAA-Paper–90-2610;CONF-9007174–: 21. AIAA, OGLR, and JSASS international electric propulsion conference, Orlando, FL (USA), 18-20 Jul 1990).

The dominant unstable electrostatic wave modes of an electromagnetically accelerated plasma are investigated. The study is the first part of a three-phase program aimed at characterizing the current-driven turbulent dissipation degrading the efficiency of Lorentz force plasma accelerators such as the MPD thruster. The analysis uses a kinetic theory that includes magnetic and thermal effects as well as those of an electron current transverse to the magnetic field and collisions, thus combining all the features of previous models. Analytical and numerical solutions allow a detailed description of threshold criteria, finite growth behavior, destabilization mechanisms and maximized-growth characteristics of the dominant unstable modes. The lower hybrid current-driven instability is implicated as dominant and was found to preserve its character in the collisional plasma regime. 22 refs.

53180 The application of the triple probe method to MPD thruster plumes. Kelly, A.J. (Princeton Univ., NJ (USA)); Jahn, R.G.; Tilley, D.L. 12p. Princeton Univ., Princeton, NJ (US) (1990). (AIAA-Paper–90-2667;CONF-9007174–: 21. AIAA, OGLR, and JSASS international electric propulsion conference, Orlando, FL (USA), 18-20 Jul 1990).

The triple probe method is an attractive technique for measuring axial and radial profiles of electron temperature T(e) and electron number density n(e) in magnetoplasmadynamic (MPD) thruster plumes. In this paper the performance and applicability of the triple probe to MPD thruster plumes is evaluated by identifying sources of error, correction methods, and error estimation techniques. Included in the analysis is an adaptation of Laframboise's exact calculations to the triple probe, aligned with the flow vector, and a

preliminary investigation of the effect of flow transverse to the probe axis. In MPD thrusters, the triple probe method can provide measurement accuracy of T(e) wintin about 10 percent and n(e) within about 60 percent. 52 refs.

53181 Anode power deposition in quasi-steady MPD thrusters. Kelly, A.J. (Princeton Univ., NJ (USA)); Jahn, R.G.; Gallimore, A.D. 10p. Princeton Univ., Princeton, NJ (US) (1990). (AIAA-Paper-90-2668;CONF-9007174--: 21. AIAA, OGLR, and JSASS international electric propulsion conference, Orlando, FL (USA), 18-20 Jul 1990).

Spatially resolved anode heat flux measurements of a pulsed quasi-steady MPD thruster have been made by embedding thermocouples to the inner surface of a hollowed anode. Results obtained using argon propellant at mass flow rates of 4 and 16 g/s with the thruster operating at currents between 8 and 24 kA are presented. The results show that the anode fall voltage increases linearly with thruster current and does not depend on propellant mass flow rate. The fraction of thruster power deposited into the anode is 42 percent at 1 MW and falls to less than 20 percent at 6 MW. At any given operating condition, there is an inverse relationship between the anode fall and anode current density. 21 refs.

3301 Internal Combustion Engines

Refer also to citation(s) 53190, 53633

53182 (AD-A-224554/6/XAB) **Experimental and theoretical evaluation of a toroidal combustion chamber for stratified-charge engines.** Quiros, E.N.; Adams, J.W.; Otis, D.R.; Myers, P.S. Wisconsin Univ., Madison, WI (USA). Dept. of Mechanical Engineering. 2 Mar 1990. 21p. Contract DAAL03-86-K-0174. Source: NTIS, PC A03/MF A01.

Maximum efficiency of cyclic combustion engines (CCE) is achieved when using stratified charge and high compression ratio with controlled air circulation and combustion. A description is given of a varying-area, toroidal-shaped combustion chamber designed to achieve the above objectives by: obtaining initial circulatory air motion induced by the piston late in the compression stroke; increasing this piston-induced velocity using the momentum of fuel injected tangentially to the center line of the toroid; and by using combustion to further increase the circulation rate. Four combustion chamber configurations were studied in a bomb with zero initial air velocity to ascertain whether significant rotation could be achieved by injection and combustion. Gas pressure was measured and high speed photographs were taken of the injection and combustion process. The ideal situation, at full load, is to have one rotation of the gas during the time allocated to combustion. The experimental results, with zero initial velocity, show that fuel momentum plus combustion produces from one-half to three-quarters of a rotation in the available time. Modeling suggests that the use of initial, piston-induced velocities would result in the desired one rotation in the available time.

53183 (CONF-9010205--1) **Interpretation of engine cycle-to-cycle variation by chaotic time series analysis.** Daw, C.S.; Kahl, W.K. Oak Ridge National Lab., TN (USA). [1990]. 13p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC05-84OR21400. From 1990 SAE international fuels and lubricants conference and exposition; Tulsa, OK (USA); 22-25 Oct 1990. Order Number DE91000729. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

In this paper we summarize preliminary results from applying a new mathematical technique – chaotic time series analysis (CTSA) – to cylinder pressure data from a spark-ignition (SI) four-stroke engine fueled with both methanol and iso-octane. Our objective is to look for the presence of "deterministic chaos" dynamics in peak pressure variations and to investigate the potential usefulness of CTSA as a diagnostic tool. Our results suggest that sequential peak cylinder pressures exhibit some characteristic features of deterministic chaos and that CTSA can extract previously unrecognized information from such data. 18 refs., 11 figs., 2 tabs.

53184 (DOE/AL/43058--T4) **Investigation of particulate formation during diesel spray combustion: Technical progress quarterly report, June 1, 1990–August 31, 1990.** United Technologies Research Center, East Hartford, CT (USA). [1990]. 6p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC04-87AL43058. Order Number DE90017871. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The objective of the contract is to conduct an experimental and analytical research program to investigate strategies for using coherent anti-Stokes Raman scattering (CARS) laser diagnostic techniques for detecting the degree of fuel pyrolysis and determining fuel-air ratio. Smoke and NO_x production rates depend in a complex way on the local temperature, the evaporation of the diesel spray, the local fuel-air ratio, and the pyrolysis history of the fuel. Furthering the ability of CARS to provide more of this information may give engine designers more insight into the combustion process and allow them to create engines which produce fewer particulates or lower amounts of NO_x. Controlling the production rates is preferable to processing emissions. If they cannot both be suppressed simultaneously, adjusting the tradeoff between producing particulates or No_x may be helpful if an exhaust processing method is available for one of them.

53185 (ORNL/Sub--87-00184/02) **Development of continuous fiber reinforced silicon nitride.** Starr, T.L. (Georgia Tech Research Inst., Atlanta, GA (USA). Energy and Materials Sciences Lab.); Harris, J.N.; Mohr, D.L.; Lyons, J.S. Oak Ridge National Lab., TN (USA); Georgia Tech Research Inst., Atlanta, GA (USA). Energy and Materials Sciences Lab. Aug 1990. 21p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC05-84OR21400. Order Number DE91001156. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Ceramic composites continue to offer great promise for increasing the efficiency of fossil fuel utilization. One particular application is for gas turbine components utilizing a direct combustion or gasification/combustion process. Turbine components have to maintain their structural integrity at high temperatures and under aggressive chemical environments. Fiber-reinforced ceramics offer increased toughness and damage tolerance while maintaining the high temperature capability and chemical stability inherent in ceramic materials. Our efforts have focused on fabrication of composites using ultrafine silicon powders prepared by attritor milling. This powder shows near full conversion in less than three hours with a maximum temperature of 1200°C. These processing conditions are suitable for composites using polymer-derived ceramic fibers. Composites were fabricated by infiltrating ceramic fiber cloths with a slurry of attritor milled silicon in ethanol. Several layers of cloth were stacked and compressed with alternating 0° – 90°C orientation to form a plate-shaped green body. The final composite was formed by heating in a nitrogen atmosphere with a temperature ramp up to 1200°C and a total processing time of less than three hours. 7 refs., 10 figs., 3 tabs.

3303 Electric-Powered Systems

53186 (EPRI-CU-6968) **Electric vehicle battery testing and development at Argonne National Laboratory: 1989 Annual report: Final report.** Smaga, J.A. (Argonne National Lab., IL (USA)); Tummilo, A.F.; Hogrefe, R.L.; Webster, C.E.; Kulaga, J.K. Electric Power Research Inst., Palo Alto, CA (USA); Argonne National Lab., IL (USA). ©Sep 1990. 63p. Sponsored by Electric Power Research Institute. DOE Contract W-31109-ENG-38. Source: Research Reports Center, Box 50490, Palo Alto, CA 94303.

The Electric Vehicle Battery Testing and Development Project for Electric Power Research Institute (EPRI) carries out selected electric vehicle (EV) battery tests and development tasks in support of the EPRI Electric Transportation Program. Overall, this program is directed at providing information to aid in the design and development of improved components and systems for electric vehicles. It is conducted by the Electrochemical Technology Department within the Chemical Technology Division of the Argonne National Laboratory (ANL) under the sponsorship and direction of the EPRI Electric Transportation Program. This report summarizes the work carried out in this program from January through December 1989. The technical tasks and activities encompassed the experimental evaluation of different nickel/iron (NIF220 and NIF200) and lead-acid

(tubular plate and gelled electrolyte) EV battery technologies, post-test analyses of NIF220 Ni/Fe cells, and special studies/analyses of the Ni/Fe battery electrolyte. 2 refs., 36 figs., 2 tabs.

3306 Vehicle Design Factors

Refer also to citation(s) 53161, 53264

53187 (ORNL/M–1248) **Advanced Materials Development Program: Ceramic Technology for Advanced Heat Engines program plan, 1983–1993.** Oak Ridge National Lab., TN (USA). Jul 1990. 66p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC05-84OR21400. Order Number DE91000516. Source: NTIS, PC A04/MF A01 - OSTI; GPO Dep.

The purpose of the Ceramic Technology for Advanced Heat Engines (CTAHE) Project is the development of an industrial technology base capable of providing reliable and cost-effective high temperature ceramic components for application in advanced heat engines. There is a deliberate emphasis on "industrial" in the purpose statement. The project is intended to support the US ceramic and engine industries by providing the needed ceramic materials technology. The heat engine programs have goals of component development and proof-of-concept. The CTAHE Project is aimed at developing generic basic ceramic technology and does not involve specific engine designs and components. The materials research and development efforts in the CTAHE Project are focused on the needs and general requirements of the advanced gas turbine and low heat rejection diesel engines. The CTAHE Project supports the DOE Office of Transportation Systems' heat engine programs, Advanced Turbine Technology Applications (ATTAP) and Heavy Duty Transport (HDT) by providing the basic technology required for development of reliable and cost-effective ceramic components. The heat engine programs provide the iterative component design, fabrication, and test development logic. 103 refs., 18 figs., 11 tabs.

3307 Emission Control

Refer also to citation(s) 53184, 53190, 53669

53188 (VW-FMT–8904-V/5) **Measurement of volatile organic components using the thermodesorption cold trap (TCT) injection technique.** Kiess, H.; Hartung, A. Volkswagenwerk AG, Wolfsburg (Germany, F.R.). Abt. Forschung und Entwicklung. 22 May 1989. 22p. (In German). Order Number DE91717006. Source: NTIS (US Sales Only), PC A03/MF A01.

High-resolution gas chromatography is a common technique for analyzing volatile constituents of complex samples. Preconcentration of the samples is usually necessary as the volumes that may be injected into a capillary gas chromatography system are limited in size. The report presents a method in which preconcentration takes place already during sampling in adsorber tubes. The substances can there be analyzed without further preparation as the combination of gas chromatography and mass spectrometry (GC/MS) provides a highly specific analytical system. Sample concentration enables also very low concentrations to be measured (ppt range). The sampling system is mobide and can be used wherever emissions occur, e.g. inside car compartments. (orig.).

3308 Alternative Fuels

53189 (ORNL/TM–11622) **Results from the second year of operation of the Federal Methanol Fleet at Oak Ridge National Laboratory.** West, B.H. (Oak Ridge National Lab., TN (USA)); McGill; Hillis, S.L. Oak Ridge National Lab., TN (USA). Sep 1990. 38p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC05-84OR21400. Order Number DE91000543. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The Oak Ridge National Laboratory has completed its second year of operation of ten vehicles for the Federal Methanol Fleet Project; five of the vehicles are fueled with methanol. Over 56,000 miles were accumulated on the vehicles in the second year bringing the total to over 152,000 miles. Energy consumption for the methanol cars was slightly higher than that of the gasoline cars again this year, most likely as a result of shorter average trip lengths for the methanol gas. Iron and lead have accumulated at greater rates in the lubricating oil of the methanol cars. Driver's ratings of vehicles reflected some dissatisfaction with the cold-weather performance of the methanol cars, but the cars have no special provisions for cold weather starting, and the fuel vapor pressure has not been tailored to the season as at other test sites. Otherwise, drivers' opinions of the methanol cars have been favorable. 13 refs., 4 figs., 10 tabs.

53190 **Methanol no better than diesel for city buses.** *Civil Engineering (New York) (USA)*, 60(5): 12-13 (May 1990).

This paper discusses how replacing diesel buses with methanol-fueled vehicles probably wouldn't improve air quality in urban areas, according to two researchers at the Argonne National Laboratory, Argonne, Ill. Because methanol doesn't ignite as easily as diesel fuel, emissions performance declines when a bus is idling or traveling at low speeds-common in city traffic. Pending Clean Air Act proposals call for introducing alternative-fueled buses in 1991 in order to reduce particulate emissions. But gains from methanol fuels could be offset by increases in carbon monoxide, formaldehyde, and hydrocarbons, based on the results of several comparative emissions tests.

35 ARMS CONTROL

Refer also to citation(s) 54419

3502 Proliferation

53191 (AD-A–224522/3/XAB) **British and French strategic nuclear force modernization: Programs, strategies, and implications. Master's thesis.** Bates, D.W. Naval Postgraduate School, Monterey, CA (USA). Dec 1989. 152p. Source: NTIS, PC A08/MF A01.

Britain and France are currently modernizing and expanding their nuclear arsenals. This thesis examines the current British and French strategic nuclear force modernization programs and weapon systems. It specifies the important differences between the two nations with regard to strategic rationales for nuclear forces and nuclear targeting. It includes an analysis of several additional factors affecting their respective modernization programs, including alternative options considered, domestic politics, technology, national economies, defense spending, and American co-operation. After examining these modernizations within the context of the past and present development of British and French deterrence and strategic nuclear policies, the thesis suggests implications for British and French nuclear programs and strategy for the next decade and into the twenty-first century.

3503 Verification

Refer also to citation(s) 53597

53192 (BNL–44846) **Assessment of the applicability of Raman spectroscopy to the detection of chemical agents.** Barletta, R.E. Brookhaven National Lab., Upton, NY (USA). Jul 1990. 13p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. Order Number DE90017198. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The use of Raman spectroscopy for the detection of chemical agents, precursors and by-product chemicals relevant to the verification of chemical weapons treaties has been evaluated. Four types of Raman-based systems have been considered: remote surveillance, field analysis (including in-plant monitoring) and microprobe analysis. The practicality of the development of such systems is dependent upon the magnitude of the Raman cross section. Since this increases with the fourth power of the frequency, the use of UV radiation is of great benefit. Further, based upon literature data, it appears that a large enhancement of the cross section for several agents can be expected in the UV due to near-resonance effects. It was concluded that Raman-based systems using UV radiation could be developed with sensitivities in the range of 100 ppM or less. 12 refs., 4 figs., 4 tabs.

53193 (BNL–45218) **CFE verification: The decision to inspect.** Allentuck, J. Brookhaven National Lab., Upton, NY (USA). [1990]. 6p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. (CONF-9010210–1: 17. annual Ottawa verification symposium, Ottawa (Canada), 3-6 Oct 1990). Order Number DE91001115. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Verification of compliance with the provisions of the treaty on Conventional Forces-Europe (CFE) is subject to inspection quotas of various kinds. Thus the decision to carry out a specific inspection or verification activity must be prudently made. This decision process is outlined, and means for "conserving quotas" are suggested. 4 refs., 1 fig.

36 MATERIALS

53194 (CDTN–ASPC,CN-001/89, pp. 125-132) **Semi-annual report of the material technology program - July to December 1988.** Moreira, P.A.; Filho, J.G.S.; Cardoso, P.E. Centro de Desenvolvimento da Tecnologia Nuclear (CDTN), Belo Horizonte, MG (Brazil). 1989. (In Portuguese). In *Semi-annual report of Nuclear Technology and Development Center (CDTN) - July to December 1988.* 353p. Order Number DE91606188. Source: NTIS (US Sales Only), PC A16/MF A01; OSTI; INIS.

The activities developed by CDTN in the materials technology program are described. The main topics are: metallography, corrosion, thermal treatment, welding and materials testing. (E.G.).

53195 (ORNL/TM–11593) **Advanced materials: Information and analysis needs.** Curlee, T.R.; Das, S.; Lee, R.; Trumble, D. Oak Ridge National Lab., TN (USA). Sep 1990. 85p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE91001017. Source: NTIS, PC A05/MF A01 - OSTI; GPO Dep.

This report presents the findings of a study to identify the types of information and analysis that are needed for advanced materials. The project was sponsored by the US Bureau of Mines (BOM). It includes a conceptual description of information needs for advanced materials and the development and implementation of a questionnaire on the same subject. This report identifies twelve fundamental differences between advanced and traditional materials and discusses the implications of these differences for data and analysis needs. Advanced and traditional materials differ significantly in terms of physical and chemical properties. Advanced material properties can be customized more easily. The production of advanced materials may differ from traditional materials in terms of inputs, the importance of by-products, the importance of different processing steps (especially fabrication), and scale economies. The potential for change in advanced materials characteristics and markets is greater and is derived from the marriage of radically different materials and processes. In addition to the conceptual study, a questionnaire was developed and implemented to assess the opinions of people who are likely users of BOM information on advanced materials. The results of the questionnaire, which was sent to about 1000 people, generally confirm the propositions set forth in the conceptual part of the study. The results also provide data on the categories of advanced materials and the types of information that are of greatest interest to potential users. 32 refs., 1 fig., 12 tabs.

53196 (UCRL–53943-89) **Chemistry and Materials Science Department annual report, 1988–1989.** Borg, R.J.; Sugihara, T.T.; Cherniak, J.C.; Corey, C.W. (eds.). Lawrence Livermore National Lab., CA (USA). [1989]. 192p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. Order Number DE91000510. Source: NTIS, PC A09/MF A01 - OSTI; GPO Dep.

This is the first annual report of the Chemistry & Materials Science (C&MS) Department. The principal purpose of this report is to provide a concise summary of our scientific and technical accomplishments for fiscal years 1988 and 1989. The report is also tended to become part of the archival record of the Department's activities. We plan to publish future editions annually. The activities of the Department can be divided into three broad categories. First, C&MS staff are assigned by the matrix system to work directly in a program. These programmatic assignments typically involve short deadlines and critical time schedules. A second category is longer-term research and development in technologies important to Laboratory programs. The focus and direction of this technology-base work are generally determined by programmatic needs. Finally, the Department manages its own research program, mostly long-range in outlook and basic in orientation. These three categories are not mutually exclusive but form a continuum of technical activities. Representative examples of all three are included in this report. The principal subject matter of this report has been divided into six sections: Innovations in Analysis and Characterization, Advanced Materials, Metallurgical Science and Technology, Surfaces and Interfaces, Energetic Materials and Chemical Synthesis, and Energy-Related Research and Development.

3601 Metals and Alloys

Refer also to citation(s) 52641, 52643, 52815, 52882, 52969, 52971, 52979, 52991, 52996, 52997, 52998, 52999, 53000, 53001, 53002, 53003, 53004, 53005, 53049, 53062, 53067, 53187, 53289, 53333, 53352, 53378, 53430, 53431, 53432, 53433, 53600, 54187, 54192, 54232, 54233, 54371, 54379

53197 (AD-A–224218/8/XAB) **Matrix-composition effects on the tensile properties of tungsten-molybdenum heavy alloys.** Bose, A.; German, R.M. Rensselaer Polytechnic Inst., Troy, NY (USA). May 1990. 4p. Contract DAAL03-87-K-0072. Source: NTIS, PC A01/MF A01.

Pub. in Metallurgical Transactions A, 1325-1326(May 1990).

Tungsten-base heavy alloys are liquid-phase sintered from mixed tungsten, nickel, and iron powders. The sintered product is a composite consisting of interlaced tungsten and solidified matrix (W-Ni-Fe) phases. These alloys are most useful in applications requiring high density, strength, and toughness. The design of improved tungsten heavy alloys has been the subject of several research investigations as summarized in References 1 through 5. Much success has taken place through improved processing, but parallel compositional studies have resulted in new microstructure-property combinations. As part of these investigations, the Ni/Fe ratio has been varied, with the general conclusion that optimal strength and ductility occur with a ratio between 2 and 4.

53198 (AD-A–224220/4/XAB) **Microstructure and impurity effects on tungsten heavy alloys. Final report, May 1987-April 1990.** German, R.M. Rensselaer Polytechnic Inst., Troy, NY (USA). 12 Jul 1990. 20p. Contract DAAL03-87-K-0072. Source: NTIS, PC A03/MF A01.

The research performed in this study focused on improved tungsten heavy alloys through process optimization as measured by affects on microstructure and impurity concentrations. This largely was performed by alloying and adjusting the sintered microstructure through processing changes. Many past heavy alloy studies have failed to couple the two activities. As a consequence, potentially beneficial alloying effects have been masked by incomplete densification. Alternatively, novel processing approaches have been unsuccessful because they were applied to conventional alloys. This research has advanced both aspects, leading to novel heavy alloys with tantalum, rhenium, or molybdenum alloying.

53199 (AD-A–224380/6/XAB) **Superconducting thin films, composites, and functions. Interim technical report, 1 October 1984-31 March 1985.** Geballe, T.H. Stanford Univ., CA (USA). Dept. of Applied Physics. Aug 1985. 8p. Contract F49620-82-C-0014. Source: NTIS, PC A02/MF A01.

The important issue of how the superconducting transition temperature Tc in disordered systems changes near the M-I transition where strong localization is expected has been studied in the Mo-Ge system. In the high Mo concentration, which is in the weakly localized regime, Tc decreases linearly with decreasing Mo concentration from 7.5 K (78 at Mo) at a rate of 0.18 K/at % Mo. In this region the ratio of electron-phonon coupling constant Lambda to the bare density of states Mb (0) is constant, which is consistent with the Varma-Dynes tight-binding model. An extrapolation of the linear behavior of Tc in this regime yields the disappearance of Tc near 35 at Mo. However, measurements show that Tc exists down

to 13.5 at Mo. A non-superconducting metallic phase is found to exist between 13.5 at 10.4 at Mo at which concentration the insulating phase occurs.

53200 (BISI–26853) **Deposition of corrosion products released from stainless steel in liquid sodium.** Yokota, N. (Hitachi Ltd., Ibaraki (Japan). Energy Research Lab.); Shimoyashiki, S. Institute of Metals, London (UK). [1990]. 14p. Translated from J. Jpn. Inst. Met. (1988) v. 52(3) p. 320-326. (CONF-8705410–: IAEA working group on high-speed reactors, Karlsruhe (Germany, F.R.), 5-8 May 1987). Source: Available from The British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

Translated from J. Jpn. Inst. Met. (1988) v. 52(3) p. 320-326.

This paper describes an investigation of the deposition of radioactive corrosion products in thermally convective sodium using a specially constructed SUS 304 stainless steel sodium pot in the temperature range between 833 and 943 K. The shapes and chemical compositions of the deposited particles are analyzed. The deposited particles can be classified into the following three types: (a) a polyhedral particle with a high iron content; (b) a hexagonal plate particle with a high chromium content; and (c) a particle without any particular shape with a similar composition to that of SUS 304 stainless steel but with a lower chromium content. The compositions of particles (a) and (c) follow the precipitation lines of the Fe-Cr-Ni ternary phase diagram at 833 K. Fe, Cr, and Ni released into the sodium are thus deposited to form particles having the chemical composition found along the precipitation lines. The size of the polyhedral particle is 3 μm. When the polyhedral particles grow larger than 3 μm, crystal growth occurs alonf the (100) and (110) planes to form a chain particle. The size of the hexagonal plate particle is 0.3 μm. The particle size distribution of all three particle shapes shows an average diameter of 4 μm and a standard deviation of 2 in a logarithmic normal distribution. (author).

53201 (BNL–45147) **EXAFS [Extended X-ray Absorption Fine-Structure Spectroscopy] study of the position of Zr within the unit cell of Sm_2Co_{17}.** Rabenberg, L. (Texas Univ., Austin, TX (USA). Center for Materials Science and Engineering); Barrera, E.V.; Maury, C.E.; Allibert, C.H.; Heald, S.M. Brookhaven National Lab., Upton, NY (USA). [1990]. 10p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. (CONF-901004–7: Conference on magnetism and magnetic materials, San Diego, CA (USA), 30 Oct - 2 nov 1990). Order Number DE91001123. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Extended X-ray Absorption Fine-Structure Spectroscopy (EXAFS) has been used to determine the position of Zr within the unit cell of Sm_2Co_{17}. Zr is routinely added to Sm_2Co_{17} permanent magnet alloys because of its effects on their metallurgical development, but the details of its behavior remain controversial. Induction melted Sm_2Co_{17}:Zr ternary alloys, aged at 1180°C, then quenched, consisted of intimately mixed H2:17 and R2:17 having Zr in solid solution as well some regions of R2:17 that were poor in Zr. EXAFS spectroscopy of these specimens indicates that the most probable position for Zr is a site having two Sm near neighbor atoms and 11 Co atoms distributed over three different interatomic distances. This is consistent with a direct substitution of Zr for Co in the Co site in the mixed planes (12j in $P6_3/mmc$, or 18f in R3m). These results are discussed in terms of the metallurgy of 2:17 magnet alloys. 20 refs., 2 figs.

53202 (CBPF-NF–001/90) **Magnetic response of localized spins coupled to itinerant electrons in an inhomogeneous crystal field.** Iannarella, L. (Universidade Federal Rural do Rio de Janeiro, RJ (Brazil). Dept. de Fisica); Guimaraes, A.P.; Silva, X.A. da. Centro Brasileiro de Pesquisas Fisicas (CBPF), Rio de Janeiro, RJ (Brazil). 1990. 14p. Order Number DE91605636. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

The magnetic behavior at T = O K of a system consisting of conduction electrons coupled to localized electrons, the latter submitted to an inhomogeneous crystal field distribution, is studied. The study implies that the inhomogeneity of the crystal field attenuates the quenching effects. The model is interesting to the study of disordered rare-earth intermetallic compounds. (A.C.A.S.).

53203 (CEA-CONF–10079) **Nuclear and magnetic medium range order in amorphous $Tb_{65}Cu_{35}$ and $Er_{69.5}Cu_{30.5}$ alloys.** Boucher, B. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Service de Physique du Solide et de Resonance Magnetique); Sanquer, M.; Tourbot, R.; Chieux, P. CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Service de Physique du Solide et de Resonance Magnetique. 1989. 4p. (CONF-8909267–: 7. international conference on liquid and amorphous metals, Kyoto (Japan), 4-8 Sep 1989). Order Number DE91709421. Source: NTIS (US Sales Only), PC A02/MF A01.

Small angle neutron scattering on amorphous and mechanical polished $Tb_{65}Cu_{35}$ and $Er_{69.5}Cu_{30.5}$ alloys has been measured at different temperatures between 4 and 300K on samples cooled in zero or in applied magnetic fields. The isotropic scattering is analyzed quantitatively in terms of spatial variations of chemical concentration or magnetization. The influence of the magnetic field is discussed.

53204 (CEA-CONF–10122) **Positron lifetime in electron irradiated FeNiCr austenitic alloys.** Huguenin, D. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France). Dept. de Recherche Fondamentale); Moser, P.; Vanoni, F.; Corbel, C. CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France). Dept. de Recherche Fondamentale. 1988. 3p. (CONF-8808122–: 8. international conference on positron annihilation, Gent (Belgium), 29 Aug - 3 sep 1988). Order Number DE91716212. Source: NTIS (US Sales Only), PC A02/MF A01.

Information about the vacancy clustering process in austenitic stainless steel is of great importance for the nuclear industry. This problem is complex and for simplification, several authors studied the behaviour of electron irradiated stainless steel made of very pure component. A study of this problem using positron lifetime technique was developed. This paper is a continuation of this study and describes results obtained after 293 K, and 323 K electron irradiation.

53205 (CNIC–00248) **The preparation of self-supporting metallic targets with rolling.** Xu Guoji (Academia Sinica, Beijing, BJ (China). Inst. of Atomic Energy); Sun Shuhua; Luo Xinghua. China Nuclear Information Centre, Beijing, BJ (China). 1988. 6p. (In Chinese). (IAE–0060). Order Number DE91605630. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

The Procedure of making metal targets with rolling is described. The technique of preparing soft metal targets of Pb, Sn, In, Al, Au and Ag and the procedure of intermediate annealing for some elements such as Mo, W, Hf, Co and Rh are discussed. The method for controlling and measuring of target thickness is mentioned.

53206 (CNIC-I–004, pp. 93-94) **A heat treatment equipment with multiple functions.** Wang Zhiguang; Hou Mingdong; Zhu Zhiyong; Chen Keqing; Ma Feng; Chen Jiachao. China Nuclear Information Centre, Beijing, BJ (China); Academia Sinica, Lanzhou, GS (China). Inst. of Modern Physics. Jun 1990. In *IMP annual report, 1988 (January-December).* 138p. Order Number DE91606195. Source: NTIS (US Sales Only), PC A07/MF A01; OSTI; INIS.

Published in summary form only. HEAT TREATMENTS/ equipment; ALLOYS; ANNEALING; FURNACES; EQUIPMENT; METALS; TEMPERATURE CONTROL; VACUUM SYSTEMS

53207 (CONF-901004–8) **High energy spin waves in BCC iron.** Perring, T.G. (Oxford Univ. (UK). Clarendon Lab.); Boothroyd, A.T.; Paul, D.McK.; Taylor, A.D.; Osborn, R.; Newport, R.J.; Blackman, J.A.; Mook, H.A. Oak Ridge National Lab., TN (USA). [1990]. 12p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From Conference on magnetism and magnetic materials; San Diego, CA (USA); 30 Oct - 2 nov 1990. Order Number DE91001273. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

We have studied the dispersion relation of the spin wave excitations in bcc iron by neutron inelastic scattering at the spallation neutron source ISIS. Magnetic intensity was followed up to 550meV along the [100] direction. The general form of the dispersion curve is in qualitative agreement with that calculated from a spin-polarised band model, and in particular we have confirmed the prediction of propagating modes extending above 300meV. 7 refs., 3 figs.

53208 (CONF-901035–8) **Defect and impurity effects on the initial growth of Ag on Si(111).** Zuo, J.K.; Wendelken, J.F. Oak Ridge National Lab., TN (USA). Oct 1990. 23p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From 37. national American Vacuum Society symposium; Toronto (Canada); 8-12 Oct 1990. Order Number DE91001277. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Step and impurity effects on the initial growth of a thin film have been demonstrated in the ($\sqrt{3} \times \sqrt{3}$)R30° domain growth of Ag on Si(111) using high angular resolution LEED. Anisotropy in the $\sqrt{3}$ domain shape and growth during deposition are found on the stepped Si(111) with the preferential growth along the step edge direction. The $\sqrt{3}$ superlattice grows with coverage principally by domain coalescence at the temperature $T \sim 450°C$ and is self-similar at different coverages (scaling) as observed on a flat Si(111). The size distribution is shown to follow a Gamma distribution by a simple model calculation. A dramatic change in the growth mechanism is observed when oxygen impurities ($\leq$0.02 ML) appear. The $\sqrt{3}$ domains in the presence of impurities grow with coverage more randomly and isotropically in contrast with the step edge effects and coalescence is inhibited. As a result, the $\sqrt{3}$ superlattice stays in a microdomain morphology without long range order. 17 refs., 6 figs.

53209 (DOE/ER/45141–T5) **Micromechanisms of brittle fracture: Acoustic emissions and electron channeling analyses.** Gerberich, W.W. Minnesota Univ., Minneapolis, MN (USA). Dept. of Chemical Engineering and Materials Science. Jun 1990. 11p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-84ER45141. Order Number DE91000987. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The objectives of this work are to: (i) Evaluate the initial stages of cleavage nucleation in single and polycrystalline samples; (ii) Determine the controlling event(s) which lead(s) to unstable cleavage (is it an unstable "cluster" of microcracks or a crack-tip opening displacement criterion for an array of ligaments surrounding these microcracks?); (iii) Determine how the process zone, which depends upon microstructure and processing history, affects the controlling event(s); (iv) Use selected area channeling patterns (SACP's) to assist in an independent measure of the cleavage fracture stress of grains cleaved at or just outside the elastic-plastic boundary; also, use it to evaluate static and dynamic strain distributions; and (v) Evaluate the effects of dislocation shielding and overload using combined methods of computational mechanics with discretized dislocation arrays and direct observations of dislocations using channeling, etch pit and birefringence methods. Accomplishments are discussed. 15 refs., 3 figs.

53210 (DOE/ER/45246–T1) **Study of the embedded atom method of atomistic calculations for metals and alloys: Annual progress report.** Johnson, R.A. Virginia Univ., Charlottesville, VA (USA). School of Engineering and Applied Science. Oct 1990. 6p. Sponsored by U.S. DOE Energy Research. DOE Contract FG05-86ER45246. (UVA–527359/MS91/102). Order Number DE91001640. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

Two projects were completed in the past year. The stability of a series of binary alloys was calculated using the embedded-atom method (EAM) with an analytic form for two-body potentials derived previously. Both disordered alloys and intermetallic compounds with the $L1_0$ and $L1_2$ structures were studied. The calculated heats of solution of alloys of Cu, Ag, Au, Ni, and Pt were satisfactory, while results for alloys containing Pd were too high. Atomistic calculations using the EAM were also carried out for point defects in hcp metals. By comparison with results in the literature, it was found that many body effects from the EAM significantly alter predicted physical properties of hcp metals. For example, the EAM calculations yield anisotropic vacancy diffusion with greater vacancy mobility in the basal plane, and imply that diffusion will start at a lower fraction of the melting temperature.

53211 (DOE/ER/45337–1) **A study of scale cracking and its effects on oxidation and hot corrosion: Final report, November 1, 1987–October 31, 1990.** Shores, D.A.; Stout, J.H.; Gerberich, W.W. Minnesota Univ., Minneapolis, MN (USA). Corrosion Research Center. May 1990. 25p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-88ER45337. Order Number DE91001327. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

For many high temperature applications, oxidation (or hot corrosion) is an important mode of degradation of metals and alloys. Degradation mechanisms may be divided into two categories: one dealing with the chemical and transport aspects of scale growth or dissolution, and the other dealing with mechanical aspects such as stresses and scale fracture. Some applications, such as corrosion/erosion, combine both aspects in a complicated manner. Much research has been concerned with relationships between alloy composition and scale growth rates, attempting to identify alloy compositions and growth mechanisms that form compact, slow-growing scales, such as Cr_2O_3 or Al_2O_3. Nevertheless, in practice a very common mode of scale degradation is cracking and spalling, followed by re-oxidation. Efforts to understand scale stresses and ultimately scale fracture have been hampered by the simultaneous interaction of numerous variables in determining the state of stress. Thus complex issues are involved in both experimental measurements and theoretical models of stresses and fracture of oxide scales. In this study we have considered both chemical/transport issues (as applied to the oxidation and hot corrosion of SiC and Ni-Cr Alloys) and mechanical issues of oxidation, but the emphasis has been on mechanical issues. In the following sections we will briefly describe the highlights of each of several projects, and where appropriate, will attach preprints or reprints of papers that describe in more detail the results of a particular study.

53212 (EUR–12575) **Residual cold-work determination by X-ray diffraction.** Pireau, A. (Societe Belge pour l'Industrie Nucleaire, Brussels (BE)); Vanderborck, Y. Commission of the European Communities, Luxembourg (Luxembourg). 1990. 118p. Contract No RA1-0109-B. Source: NTIS (US Sales Only), PC A06/MF A01.

The determination of the cold-work level of materials for fast breeder reactors can be made by different techniques. The report compares different methods for an application on austenitic stainless steels and demonstrates that the X-ray diffraction procedure is a reliable technique. A round robin test has been performed between three laboratories; the results are presented and discussed.

53213 (IS-T–1415) **Low-energy electron diffraction investigation of epitaxial growth: Pt and Pd on Pd(100).** Flynn-Sanders, D. Ames Lab., IA (USA). 21 Sep 1990. 235p. Sponsored by U.S. DOE Energy Research; National Science Foundation. DOE Contract W-7405-ENG-82. Grant CHE-8451317. Order Number DE91000750. Source: NTIS, PC A11/MF A01 - OSTI; GPO Dep.

We investigate the epitaxial growth of Pt and Pd and Pd(100) via spot profile analysis using conventional low-energy electron diffraction (LEED). We resolve a central-spike and diffuse component in the spot profiles, reflecting the layer-occupations and pair-correlations, respectively. Kinetic limitations inhibit layer-by-layer growth at low temperatures. Our data suggest diffusion switches on at ca. 150 K for Pt and ca. 170 K for Pd indicating activation barriers to surface diffusion of ca. 10 and ca. 13 kcal/mol, respectively. To clarify the role of diffusion in determining the resulting film morphology, we develop a growth model that incorporates the adsorption-site requirement and predicts intensity oscillations. We present a new procedure to experimentally determine out-of-phase scattering conditions. At these energies, ring-structure is evident in the profiles during Pd growth between ca. 200 and 400 K. We report ring intensity oscillations as a function of coverage, which demonstrate the filling of individual layers.

53214 (IS-T–1441) **Fundamental investigations of supported monometallic and bimetallic catalysts by proton magnetic resonance spectroscopy.** Wu, Xi. Ames Lab., IA (USA). 21 Sep 1990. 410p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-82. Order Number DE91000610. Source: NTIS, PC A18/MF A01 - OSTI; GPO Dep.

Proton magnetic resonance spectroscopy, or nuclear magnetic resonance (NMR) of hydrogen, has been applied to investigate silica-supported Group VIII monometallic and Group VIII-Group IB bimetallic catalysts and alumina- and silica-supported platinum-rhenium bimetallic catalysts. Two adsorbed states of hydrogen, i.e., irreversible and reversible hydrogen, on the surfaces of monometallic Ru, Pt, and Cu particles and bimetallic Ru-Group Ib, Pt-Group Ib, and Pt-Re particles were observed directly via proton NMR. The

same amounts of the irreversible hydrogen adsorbed on pure Ru catalysts were measured by both proton NMR and the volumetric technique. The electronic environments on surfaces of monometallic catalysts are sensitive to changes in metal dispersion, state of adsorbed hydrogen, and residual chlorine. Surface compositions for the Ru–Cu and Pt–Cu bimetallic catalysts were determined by NMR of adsorbed hydrogen. 297 refs., 96 figs., 19 tabs.

53215 (IS-T–1464) **The growth, structure, and thermal stability of vapor deposited ultra-thin metal films: Rh on Ag(100), Au on Pd(110), and Pt on Pd(110).** Schmitz, P. Ames Lab., IA (USA). 21 Sep 1990. 252p. Sponsored by National Science Foundation. DOE Contract W-7405-ENG-82. Order Number DE91000608. Source: NTIS, PC A12/MF A01 - OSTI; GPO Dep.

The growth, structure, and thermal stability of ultra-thin metal films (Rh on Ag(100); Au on Pd(110) and Pt on Pd(110)) is investigated using surface sensitive techniques. The three systems studied present a variety of differing characteristics which can contribute to the growth mode, two-dimensional structure, and thermal stability of the films. The main factors contributing to the differing properties of the three systems presented here are: (1) the different substrate morphologies; (2) the differences in surface free energies between the overlayer and the substrate; (3) the degree of lattice mismatch for a particular system; and (4) the extent of miscibility of the two metals. 200 refs., 38 figs.

53216 (IS-T–1495) **Optical properties and electronic structures of d- and f-electron metals and alloys, Ag-In, Ni-Cu, $AuGa_2$, $PtGa_2$, β'-NiAl, β'-CoAl, $CeSn_3$, and $LaSn_3$.** Kim, Kwang Joo. Ames Lab., IA (USA). 17 Oct 1990. 109p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-82. Order Number DE91001597. Source: NTIS, PC A06/MF A01 - OSTI; GPO Dep.

Optical properties and electronic structures of disordered $Ag_{1-x}In_x$(x = 0.0, 0.04, 0.08, 0.12) and $Ni_{1-x}Cu_x$ (x = 0.0, 0.1, 0.3, 0.4) alloys and ordered $AuGa_2$, $PtGa_2$, β'-NiAl, β'-CoAl, $CeSn_3$, and $LaSn_3$ have been studied. The complex dielectric functions have been determined for $Ag_{1-x}In_x$, $Ni_{1-x}Cu_x$, $AuGa_2$, and $PtGa_2$ in the 1.2–5.5 eV region and for $CeSn_3$ and $LaSn_3$ in the 1.5–4.5 eV region using spectroscopic ellipsometry. Self-consistent relativistic band calculations using the linearized-augmented-plane-wave method have been performed for $AuGa_2$, $PtGa_2$, β'-NiAl, β'-CoAl, $CeSn_3$, and $LaSn_3$ to interpret the experimental optical spectra.

53217 (IS-T–1515) **Application of ultrasonic guided waves to the characterization of texture in metal sheets of cubic and hexagonal crystallites.** Li, Yan. Ames Lab., IA (USA). 8 Oct 1990. 251p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-82. Order Number DE91001107. Source: NTIS, PC A12/MF A01 - OSTI; GPO Dep.

Ultrasonic techniques have recently been applied to the texture characterization in polycrystalline aggregates of hexagonal crystals. The basis of this application lies in the relations between the elastic constants $\bar{C}_{ij}$ of the aggregates, which can be inferred from ultrasonic wave velocity measurements, and the orientation distribution coefficients. This communication present such relations for aggregates which possess orthotopic material symmetry and hexagonal crystal symmetry for Voigt, Reuss, and Hill averaging methods in a unified and concise representation.

53218 (Juel–2354) **The diffusion of helium in bcc and hexagonal metals.** Vassen, R.P. Forschungszentrum Juelich GmbH (Germany, F.R.). Inst. fuer Festkoerperforschung; Technische Hochschule Aachen (Germany, F.R.). Apr 1990. 143p. (In German). Order Number DE91717319. Source: NTIS (US Sales Only), PC A07/MF A01.

Foil specimens (2.5-85.0 μm) of V, Fe (bcc) and Ti, Co and Mg (hcp) were homogenously implanted with helium to final concentrations between 0.001 ppm and 5 ppm. By subsequent thermal desorption measurements three regimes of different desorption behaviour were identified: (1) Free diffusion determined the helium-release as long as the mean distance between a helium atom and the surface was small compared to the mean distance between the helium atoms. For titanium a substitutional mechanismen was proposed, while in all the other metals helium diffuses by a dissociative mechanism with recapture at thermal vacancies (Mg, Co) and implantation-induced vacancies (V, Fe), respectively. (2) Free diffusion was reduced by the agglomeration of helium atoms. The amount of helium released during free diffusion depended on the thickness d and the helium-concentration c_0 as $1/d\sqrt{c_0}$. This dependence was explained by a simple agglomeration-model. (3) After the formation of helium-bubbles a small helium-release persisted. This could be explained by two different coarsening mechanismens: Bubble-migration and -coalescence (e.g. Mg) and Ostwald-ripening (e.g. Ti). (orig.).

53219 (Juel–2362) **The influence of small SO_2 additions on the corrosion behaviour of NiCrAl alloys at 1000-1100deg C.** Wasserfuhr, C.H.; Quadakkers, W.J.; Schuster, H.; Nickel, H. Forschungszentrum Juelich GmbH (Germany, F.R.). Inst. fuer Reaktorwerkstoffe; Technische Hochschule Aachen (Germany, F.R.). Jun 1990. 145p. (In German). Order Number DE91717223. Source: NTIS (US Sales Only), PC A07/MF A01.

Dissertation submitted by C.H. Wasserfuhr.

The corrosion behaviour of NiCrAl alloys in air containing small amounts of SO_2 has been investigated. The alloys containing 9-20 wt.% chromium and 6-10 wt% aluminium were oxidized in air and in air containing 1 vol% SO_2. In addition to long term tests, the initial stages of oxidation were examined using various surface analysis techniques. The results have shown that small SO_2 additions to the test atmosphere cause a much higher oxidation rate, especially for cast alloys of low chromium and high aluminium contents. The mechanism of the deleterious effect of SO_2 on the oxidation rate was studied in two ways: measurement of the gas-metal reaction kinetics using gas chromatographical analysis of the test gas, investigation of trace amounts of sulphur in the alloy. On the basis of the results obtained, it can be shown that the high oxidation rates caused by the presence of SO_2 in the test atmosphere can be significantly reduced by increasing the chromium content of the alloy, by adding yttrium to the alloy, and by ensuring a fine-grained microstructure. (orig.).

53220 (Juel-Conf–71, pp. 206-227) **Methods for very high temperature design.** Blass, J.J. (Oak Ridge National Lab., TN (USA). Engineering Technology Div.); Corum, J.M.; Chang, S.J. Kernforschungsanlage Juelich GmbH (Germany, F.R.). Apr 1989. Contract DE-AC05-84OR21400. (CONF-890186–: Workshop on structural design criteria for HTR, Julich (Germany, F.R.), 31 Jan - 1 feb 1989). In *Proceedings of the workshop on structural design criteria for HTR4.* 557p. Order Number DE91717019. Source: NTIS (US Sales Only), PC A24/MF A01.

The purpose is to provide a synopsis of the significant differences between the draft Case and N-47, and to provide more complete accounts of the development of allowable stress and stress rupture values and the development of isochronous stress vs strain curves, in both of which ORNL played a principal role. The isochronous curves, which represent average behavior for many heats of Inconel 617, were based in part on a unified constitutive model developed at ORNL. Details are also provided of this model of inelastic deformation behavior, which does not distinguish between rate-dependent plasticity and time-dependent creep, along with comparisons between calculated and observed results of tests conducted on a typical heat of Inconel 617 by GE for DOE. (orig./DG).

53221 (Juel-Conf–71, pp. 228-242) **Life fraction rules.** Maile, K. (Stuttgart Univ. (Germany, F.R.). Staatliche Materialpruefungsanstalt). Kernforschungsanlage Juelich GmbH (Germany, F.R.). Apr 1989. (CONF-890186–: Workshop on structural design criteria for HTR, Julich (Germany, F.R.), 31 Jan - 1 feb 1989). In *Proceedings of the workshop on structural design criteria for HTR.* 557p. Order Number DE91717019. Source: NTIS (US Sales Only), PC A24/MF A01.

Evaluations for lifetime estimation of high temperature loaded HTR-components under creep fatigue load had been performed. The evaluations were carried out on the basis of experimental data of strain controlled fatigue tests with respectively without hold times performed on material NiCr 22 Co 12 Mo (Inconel 617). Life prediction was made by means of the linear damage accumulation rule. Due to the high temperatures no realistic estimates of creep damage can be obtained with this rule. Therefore the rule was modified. The modifications consist in a different analysis of the relaxation curve including different calculation of the creep damage

estimate resp. in an extended rule, taking into consideration the interaction between creep and fatigue. In order to reach a better result transparency and to reduce data set dependent result scattering a round robin with a given data set was carried out. The round robin yielded that for a given test temperature of T = 950deg C realistic estimate of damage can be obtained with each modification. Furthermore a reduction of resulting scatterbands in the interaction diagram can be observed, i.e. the practicability of the rule has been increased. (orig.).

53222 (KURRI-TR–330, pp. 50-52) **Neutron irradiation damge in Fe-Cr-Mn-XNi alloys.** Ohnuki, S. (Hokkaido Univ., Sapporo (Japan). Faculty of Engineering); Takahashi, H. Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst. Mar 1990. (In Japanese). (CONF-8908245–: Workshop on development and application of low temperature irradiation and irradiation facilities; Workshop on development and application of low temperature irradiation and irradiation facilities, Kumatori (Japan); KUMATORI (is not a va In *Proceedings of the workshop on development and application of low temperature irradiation and irradiation facilities.* 145p. Order Number DE90513870. Source: NTIS (US Sales Only), PC A07/MF A01.

Published in summary form only. IRON BASE ALLOYS/physical radiation effects; AUSTENITIC STEELS/physical radiation effects; RADIOACTIVITY; CHROMIUM ALLOYS; MANGANESE ALLOYS; NICKEL ALLOYS; SILICON ALLOYS; DENSITY; VOIDS; PHASE TRANSFORMATIONS; MARTENSITE; NEUTRONS; IRRADIATION

53223 (KURRI-TR–330, pp. 21-25) **Importance of irradiation temperature on the study of neutron irradiation damages in metals.** Yoshiie, Toshimasa (Hokkaido Univ., Sapporo (Japan). Faculty of Engineering); Kiritani, Michio. Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst. Mar 1990. (In Japanese). (CONF-8908245–: Workshop on development and application of low temperature irradiation and irradiation facilities; Workshop on development and application of low temperature irradiation and irradiation facilities, Kumatori (Japan); KUMATORI (is not a va In *Proceedings of the workshop on development and application of low temperature irradiation and irradiation facilities.* 145p. Order Number DE90513870. Source: NTIS (US Sales Only), PC A07/MF A01.

Published in summary form only. PHYSICAL RADIATION EFFECTS/temperature dependence; GOLD/physical radiation effects; NICKEL/physical radiation effects; GOLD; NICKEL; IRRADIATION; THERMAL REACTORS; ENERGY DEPENDENCE; NEUTRON SOURCE FACILITIES; FOILS; ELECTRON MICROSCOPY; DEFECTS; NEUTRONS

53224 (LA-UR–90-2980) **Analysis of bond quality by resonant ultrasound.** Visscher, W.M.; Migliori, A.; Dixon, R.D. Los Alamos National Lab., NM (USA). [1990]. 7p. Sponsored by U.S. DOE Office of Administration and Human Resource Management. DOE Contract W-7405-ENG-36. (CONF-900791–3: Review of progress in quantitative NDE, La Jolla, CA (USA), 15-20 Jul 1990). Order Number DE91000439. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

Analysis of the response of small samples of materials to mechanical excitations at ultrasonic frequencies (resonant ultrasound spectroscopy, or RUS) can yield much information about the sample, including its geometry, density (densities, if composite), and elastic constants. In this paper, we sketch the experimental technique, the method by which the data can be analyzed, and extend the analysis to samples which comprise two different materials bonded together. In the latter case the technique can give information about the composition of the sample and bond integrity (i.e. whether or not displacements and stresses are continuous across the interface). Comparison of calculated with measured frequencies for a bonded sample will be made. 7 refs., 5 figs.

53225 (MIC–90-04667/XAB) **Observations on the corrosion of zircaloy-2, containing palladium and gold. Report No. PM-I 62-5.** Dixon, C.F. Physical Metallurgy Research Labs., Ottawa, ON (Canada). ©1962. 9p. Source: NTIS, PC EE07/MF E01.

At the present time, zircaloy-2 is considered to be the most attractive material available for use as fuel sheathing and pressure tubing in water-cooled natural uranium nuclear reactors. However, to keep up with reactor design, considerable work is being done to develop zirconium alloys with greater strength than zircaloy-2 and with as good or better corrosion resistance. This report describes the effect of additions of 0.062 wt % Pd and 0.106 wt % Au on the corrosion resistance of zircaloy-2 in steam at 400C (750F) and 1500 psi.

53226 (MIC–90-04670/XAB) **Transformation reactions and mechanical properties of zirconium alloys containing copper and molybdenum. Report No. PM-R 60-6.** Dixon, C.F. Canada Centre for Mineral and Energy Technology, Ottawa, ON (Canada). ©1960. 24p. Source: NTIS, PC EE07/MF E01.

At the present time, zircaloy is generally considered to be the most attractive material available for water-cooled power reactor fuel cladding and core components such as pressure tubes, but projected power reactor designs already require a better material having improved mechanical properties and corrosion resistance at the higher operating temperatures contemplated. As part of the Canadian program directed toward natural uranium fuelled power reactor development, a study of zirconium-based alloys containing between 1 and 2 wt% copper, combined with from 1.5 to 2.5 wt% molybdenum was made. In this investigation, the effects of solution and ageing heat treatments were examined in metallographic structure and resulting room temperature mechanical properties. An assessment of hot working fabrication characteristics was also made.

53227 (ORNL/M–983) **Bibliography of the technical literature of the Materials Joining Group, Metals and Ceramics Division, 1951–June 1989.** David, S.A.; Goodwin, G.M.; Gardner, K. (comps.). Oak Ridge National Lab., TN (USA). Oct 1989. 52p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE91000530. Source: NTIS, PC A04/MF A01 - OSTI; GPO Dep.

This document contains a listing of the written scientific information originating in the Materials Joining (formerly the Welding and Brazing Group), Metals and Ceramics Division, Oak Ridge National Laboratory during 1951 through June 1989. This registry of documents is as much as possible, in the order of issue date. A complete cross-referenced listing of the technical literature of the Metals and Ceramics Division is also available.

53228 (RFP–4253) **Superplastic deformation properties of Ti-6Al-4V.** Zaccone, M.A.; McDonald, M.M. EG and G Rocky Flats, Inc., Golden, CO (USA). Rocky Flats Plant. 6 Aug 1990. 24p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC34-90DP62349. Order Number DE91000503. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Superplastic forming of Ti-6Al-4V was investigated with three heats of material to examine the effects of extrinsic and intrinsic variables on strain rate sensitivity and flow stress. Tension tests with strain rate jumps and step strain rate tests were used to determine the effects of strain rate, strain, and temperature on strain rate sensitivity of Ti-6Al-4V. Superplastic forming of Ti-6Al-4V is strongly influenced by deformation temperature. The uniform elongation and the strain rate sensitivity were maximized at 900°C in the temperature range tested. In the strain rate range tested, strain rate sensitivity increased slightly as the strain rate decreased. In examining the results, it was apparent that at high strains, grain growth decreased strain rate sensitivity. This decrease was a strong function of temperature, which minimized at 875°C. The strong dependence of superplastic behavior on temperature can be related to relative amounts of alpha and beta in the microstructure, as shown in the model for superplastic deformation of Ti-6Al-4V.

53229 (RFP–4432) **Development of models for welding applications.** Roper, J.R.; Hayer, L.K. EG and G Rocky Flats, Inc., Golden, CO (USA). [1990]. 21p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC34-90DP62349. (CONF-9009231–2: MARC finite element analysis users conference, Monterey, CA (USA), 20-21 Sep 1990). Order Number DE91001101. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The modeling of welding processes offers considerable potential for help with manufacturing problems but a complete definition of

any welding process offers many challenges. However, the modular structure of MARC, and the diverse range of capabilities offered, create a good opportunity for development in this area. This paper discusses these problems and describes techniques used to overcome some of them. Models have been developed to simulate gas tungsten arc (GTA) and electron beam (EB) welding with a moving heat source. Fortran routines for subroutines FLUX and FORCDT have been written to generate a moving heat source. Sequential element activation has permitted the simulation of GTA welding with cold wire feed (CWF), as in filling of a machined weld groove. A program which generates History Definition blocks necessary for this type of welding model is also described in this paper. Semi-infinite heat transfer elements were used to get accurate temperature histories while keeping the size of the model manageable. Time-temperature histories and isothermal contours compare well with experimental measurements, although many areas for improvement and refinement remain. Results have been used to anticipate the necessity for weld parameter changes after part redesign, and the electron beam model relates closely to situations in which information is needed for the minimization of peak temperatures on the underside of the welded part. 8 refs., 11 figs.

53230 (SAND–88-1215) **Characterization of a laser-beam spinning technique.** Brandon, E. Sandia National Labs., Albuquerque, NM (USA). Jun 1990. 20p. Sponsored by U.S. DOE Energy Research. DOE Contract AC04-76DP00789. Order Number DE91000478. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The objective of this study was to evaluate the beam spinning technique for bridging gaps in butt joints that are CO_2 laser-welded. A device was designed and built to circularly oscillate a CO_2 laser beam on the plant of a work surface. A series of welds was made using a continuous-wave output power of 805 watts, and the resultant weld bead profile was characterized as a function of three process parameters. From the experimental results, predictor equations were derived for laser-beam spinning speed and amplitude of the beam spinning pattern on the work surface. The data collected in this experiment indicate that the width of the weld bead is increased by oscillating the beam and that this increase may be made without significantly reducing the weld penetration. The increased width of the weld may offer a solution to variable gaps in weld joints, which has been a recurring production problem. 13 figs., 1 tab.

53231 (SAND–90-1068C) **Amorphization of C-implanted Fe(Cr) alloys.** Knapp, J.A.; Follstaedt, D.M.; Sorensen, N.R.; Pope, L.E. Sandia National Labs., Albuquerque, NM (USA). [1990]. 13p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-900936–15: 7. international conference on ion beam modification of materials, Knoxville, TN (USA), 9-14 Sep 1990). Order Number DE91001338. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The amorphous phase formed by implanting C into Fe alloyed with Cr, which is prototype for the amorphous phase formed by implanting C into stainless steels, is compared to that formed by implanting C plus Ti into Fe and steels. The composition range of the phase has been examined; higher Cr and C concentrations are required than needed with Ti and C. The friction and wear benefits obtained by implanting stainless steels with C alone do not persist for the long durations and high wear loads found with Ti and C. However, the amorphous Fe-Cr-C alloys exhibits good aqueous corrosion resistance. 9 refs., 3 figs., 1 tabs.

53232 (SAND–90-1239C) **Effect of step edge transition rates and anisotropy in simulations of epitaxial growth.** Chason, E.; Dodson, B.W. Sandia National Labs., Albuquerque, NM (USA). [1990]. 23p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-901035–10: 37. national American Vacuum Society symposium, Toronto (Canada), 8-12 Oct 1990). Order Number DE91001251. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

We present the results of a hybrid rate equation/Monte Carlo simulation of epitaxial growth on vicinal surfaces. We have studied the effect on surface morphology of changing transition rates at step edges, of changing detachment rates from step edges and clusters, and of adding anisotropy to the diffusion and incorporation kinetics at step edges and islands. The effect of the transition rates on surface morphology are discussed in terms of a balance between growth by nucleation and coalescence of islands and by the propagation of steps. 11 refs., 6 figs., 1 tab.

53233 (SAND–90-1362C) **The influence of surface oxygen on release of deuterium from tantalum.** Wampler, W.R. Sandia National Labs., Albuquerque, NM (USA). [1990]. 19p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-901035–6: 37. national American Vacuum Society symposium, Toronto (Canada), 8-12 Oct 1990). Order Number DE91001268. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Here we examine the influence of surface oxygen on both the absorption of deuterium (D) from gas into solution i tantalum (Ta) and the release from solution back to the gas. The D uptake rate was proportional to gas pressure with a sticking coefficient of $0.0085 \pm .00025$ for clean Ta surfaces. Exposure to 10 Langmuirs (L) of O_2, giving about one monolayer of chemisorbed oxygen, decreased the D uptake rate by about two orders of magnitude. D release was studied using the $D(^3He,P)\alpha$ nuclear reaction to measure the concentration of D in the Ta versus time during release at constant temperature. D release was surface-limited and obeyed second order kinetics for both clean and oxygen covered Ta surfaces which shows that molecular recombination must be occurring from sites which have much smaller binding energies for D than the low-coverage chemisorption sites. Exposure to 10^6 L of O_2 resulted in an additional energy barrier to D recombination of $0.25 \pm .04$ eV/D which greatly reduces the D release rate. This activation barrier should also reduce D dissociation and uptake rates as observed. 17 refs., 7 figs.

53234 (SAND–90-8204) **A two-dimensional thermomechanical simulation of a gas metal arc welding process.** Ortega, A.R. Sandia National Labs., Livermore, CA (USA). Aug 1990. 30p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC04-76DR00789. Order Number DE91000489. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A low heat input gas metal arc (GMA) weld overlay process is being investigated as a possible means to repair Savannah River nuclear reactor tanks in the event cracks are detected in the reactor walls. Two-dimensional thermomechanical simulations of a GMA welding process were performed using the finite element code ABAQUS to assist in the design of the upcoming weld experiments on helium-charged specimens. The thermal model correlated well with existing test data, i.e., fusion zone depth and thermocouple data. In addition, numerical results revealed that after cool-down the final deformation of the workpiece was qualitatively similar to the shape observed experimentally. Based on these analyses, conservative recommendations were made for the workpiece dimensions, weld pass spacing, and thermomechanical boundary conditions to ensure the experiments would be as representative as possible of welding on the reactor walls. 12 refs., 13 figs.

53235 (UCID–20622-90-1) **Chemistry and materials science research report: Weapons-supporting research and departmental institutional research and development, First half FY90.** Lawrence Livermore National Lab., CA (USA). 31 May 1990. 103p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. Order Number DE91000495. Source: NTIS, PC A06/MF A01 - OSTI; GPO Dep.

The research reported here in summary form was conducted under the auspices of Weapons-Supporting Research (WSR) and Institutional Research and Development (IR&D). The period covered is the first half of FY90. The results reported here are for work in progress; thus, they may be preliminary, fragmentary, or incomplete. Research in the following areas are briefly described: energetic materials, tritium, high-Tc superconductors, interfaces, adhesion, bonding, fundamental aspects of metal processing, plutonium, synchrotron-radiation-based materials science, photocatalysis on doped aerogels, laser-induced chemistry, laser-produced molecular plasmas, chemistry of defects, dta equipment development, electronic structure study of the thermodynamic and mechanical properties of Al-Li Alloys, and the structure-property link in sub-nanometer materials.

53236 (VTT-TUTK–685) **Creep and creep failure of power plant steels.** Auerkari, P. (Valtion Teknillinen Tutkimuskeskus,

Espoo (Finland). Metallilaboratorio); Neuvonen, A.; Jokinen, J.; Salonen, J.; Maekinen, R. Valtion Teknillinen Tutkimuskeskus, Espoo (Finland). May 1990. 28p. (In Finnish). Order Number DE91707462. Source: NTIS (US Sales Only), PC A03/MF A01.

Numerical and analytical creep analysis of thick-wall tubes agrees reasonably well up to few percent of strain with experimental creep testing results of 1Cr-0.5Mo-steel tubes under internal pressure. Beyond this strain level a higher value of the creep exponent in the Norton creep law than that from uniaxial testing is needed to predict strains correctly. For detecting emerging creep damage the magnetic Barkhausen noise measurements showed some promise, when the measurements were performed with a calibration to a standard block. However, it is anticipated that the technique would work better in detecting creep cracks therefore would exhibit more potential in replacing standard surface inspection methods like magnetic particle testing.

53237 Local environmental effects in magnetic alloys and multilayers: Calculations of the static response functions. Johnson, D.D. (Theoretical Division, Sandia National Lab., Livermore, CA (US)); Staunton, J.B.; Gyorffy, B.L.; Pinski, F.J.; Stocks, G.M. pp. 121-126 of Neutron scattering for materials science. Materials Research Society proceedings: Volume 166. Shapiro, S.M.; Moss, S.C.; Jorgensen, J.D. Materials Research Society, Pittsburgh, PA (USA) (1990). pp. 499 (CONF-891119–: Materials Research Society fall meeting, Boston, MA (USA), 27 Nov - 2 dec 1989).

The authors have developed an ab-initio method for calculating the static response functions in substitutional alloys. For magnetic alloys, in addition to the nuclear diffuse scattering, a contribution to the alloy diffuse scattering intensities results from the response of the local moments to changes in the local chemical environment (i.e. j_{μ_i}/j_{c_j}) The authors present results of first-principles calculations of these local response functions in magnetic alloys. These response functions, which may be directly compared to neutron-scattering and Mößbauer experiments, are derived via a mean-field statistical mechanical description of compositional fluctuations in alloys. The statistical averages are performed via the Korringa-Kohn-Rostoker coherent potential approximation, which incorporates the electronic structure of the high-temperature, chemically disordered state.

53238 Ordering mechanism in Ni-Cr alloys: Theory and experiment. Turchi, P.E.A. (Lawrence Livermore National Lab., Livermore, CA (US)); Howell, R.H.; Wachs, A.L.; Fluss, M.J.; Pinski, F.J.; Johnson, D.D.; Stocks, G.M.; Nicholson, D.M.; Schweika, W. pp. 231-236 of Neutron scattering for materials science. Shapiro, S.M.; Moss, S.C.; Jorgensen, J.D. Materials Research Society, Pittsburgh, PA (USA) (1990). pp. 499 (CONF-891119–: Materials Research Society fall meeting, Boston, MA (USA), 27 Nov - 2 dec 1989).

Recently, short range order (SRO) parameters have been extracted from the neutron diffuse scattering intensities on Ni-Cr alloys with 11 to 25 at. pct. chromium. These data were analyzed using inverse-Monte Carlo simulations to extract atomic interactions and the results suggested the existence of a well defined, flat sheet of Fermi surface normal to the [110] direction. In this paper, this suggestion is investigated with a series of calculations which are based on the first-principles Korringa-Kohn-Rostoker-coherent-potential-approximation (KKR-CPA). The authors calculate the electronic structure and the Bloch spectral function at the Fermi energy.

53239 A first-principles study of short range order in Cu-Zn. Slutter, M. (Lawrence Berkeley Lab., Materials and Chemical Sciences Dept., Berkeley, CA (US)); Turchi, P.E.A.; Johnson, D.D.; Nicholson, D.M.; Stocks, G.M.; Pinski, F.J. pp. 255-230 of Neutron scattering for materials science. Shapiro, S.M.; Moss, S.C.; Jorgensen, J.D. Materials Research Society, Pittsburgh, PA (USA) (1990). pp. 499 (CONF-891119–: Materials Research Society fall meeting, Boston, MA (USA), 27 Nov - 2 dec 1989).

Recently, measurements of short-range order (SRO) diffuse neutron scattering intensity have been performed on quenched Cu-Zn alloys with 22.4 to 31.1 atomic percent (a/o) Zn, and pair interactions were obtained by inverse Monte Carlo simulation. These results are compared to SRO intensities and effective pair interactions obtained from first-principles electronic structure calculations. The theoretical SRO intensities were calculated with the cluster variation method (CVM) in the tetrahedron-octahedron approximation with first-principles pain interactions as input. More generally, phase stability in the Cu-Zn alloy system is discussed, using ab-initio energetic properties.

53240 Phonon dispersion and Kohn anomalies in the alloy $Cu_{0.84}Al_{0.16}$. Chou, H. (Physics Dept., Brookhaven National Lab., Upton, NY (US)); Shapiro, S.M.; Moss, S.C.; Mostoller, M. pp. 237-242 of Neutron scattering for materials science. Shapiro, S.M.; Moss, S.C.; Jorgensen, J.D. Materials Research Society, Pittsburgh, PA (USA) (1990). pp. 499 (CONF-891119–: Materials Research Society fall meeting, Boston, MA (USA), 27 Nov - 2 dec 1989).

The authors have made detailed measurements of phonon frequencies along all high-symmetry directions on a large single crystal of $Cu_{0.84}Al_{0.16}$ at room temperature. Phonon frequencies were ascertained to better than ± 0.03 meV. Inter-atomic force constants and vibrational density of states were calculated by performing a Born-von Karman analysis on the complete set of phonon dispersion curves. In contrast to the case of pure Cu, no evident Kohn anomaly (neither in the phonon dispersion itself nor in the derivatives) was observed near the expected wave vector $q = 2k_F$. The absence of Kohn anomalies in the present system could be due either to a smeared out Fermi surface or to the possibility that the electron-electron interaction which screens the inter-ionic potential is not the dominant interaction in the system: i.e., the existence of Kohn anomalies in these alloys may depend mainly on the details of the electron-phonon interaction.

53241 Influence of interstitial oxygen on the lattice parameters of solution-treated and aged Ti-8.6 wt.% Al alloys. Gray, G.T. III (Los Alamos National Lab., Los Alamos, NM (US)); Lawson, A.C. pp. 261-266 of Neutron scattering for materials science. Materials Research Society proceedings: Volume 166. Shapiro, S.M.; Moss, S.C.; Jorgensen, J.D. Materials Research Society, Pittsburgh, PA (USA) (1990). pp. 499 (CONF-891119–: Materials Research Society fall meeting, Boston, MA (USA), 27 Nov - 2 dec 1989).

Neutron powder diffraction data have been obtained on Ti-8.6wt.% Al alloys with three different oxygen contents (500, 1000, and 2000 ppm) in the solution-treated and aged condition (containing α_2) to investigate possible oxygen and aluminum ordering and lattice parameter variations. The lattice parameters a and c were found to depend on the oxygen content and heat-treatment condition. Consistent with the literature lattice parameter data on pure Ti, the a lattice parameter of the solution-treated Ti-8.6Al material is relatively insensitive to the oxygen content while the c parameter increases with increasing oxygen. Following aging to precipitate the ordered α_2, the c lattice parameter in the Ti-8.6Al alloys still exhibits a positive dependence on oxygen content with aging and a slight c increase over the solution-treated condition. The a lattice parameter following aging is observed to be lower than the solution-treated value, particularly for the 1000 and 2000ppm alloys. The diffraction data is discussed in light of parallel electron microscopy results and literature data.

53242 Non-destructive measurement of residual stresses in U-0.8 wt.% Ti by neutron diffraction. Salinas-Rodriguez, A. (Chalk River Nuclear Lab., Atomic Energy of Canada, Ltd., Chalk River, Ontario (CA)); Root, J.H.; Holden, T.M.; Macewen, S.R.; Ludtka, G.M. pp. 305-310 of Neutron scattering for materials science. Materials Research Society proceedings: Volume 166. Shapiro, S.M.; Moss, S.C.; Jorgensen, J.D. Materials Research Society, Pittsburgh, PA (USA) (1990). pp. 499 (CONF-891119–: Materials Research Society fall meeting, Boston, MA (USA), 27 Nov - 2 dec 1989).

The macroscopic residual stress distribution in γ-quenched and stress levelled U-0.8wt% Ti alloy tubes was studied using neutron diffraction techniques. Residual strains were evaluated from the difference in d-spacings measured in the tubes and in small reference samples machined from each tube. Residual stresses were calculated with the isotropic bulk value of the elastic constraints for polycrystalline α-U. Quenching from the γ field resulted in a nearly equi-biaxial stress state at every point across the wall thickness of

the tube. The magnitude of the radial stress was very small compared with that of the axial and hoop stresses which were compressive at the surfaces and tensile in the interior. Stress levelling relieved almost completely the hoop residual stress without affecting the radial stress. The axial residual stress becomes tensile through the wall thickness and remains constant at about 20% of its magnitude in the as-quenched condition.

53243 High-temperature properties of particle-strengthened W-Re. Shin, K.S. (Arizona State Univ., Tempe, AZ (US)); Luo, A.; Chen, B.L.; Jacobson, D.L. *JOM (1989) (USA)*, 42(8): 12-15 (Aug 1990).

In recent years there has been renewed interest in the development of tungsten alloys for space power and advanced aerospace propulsion systems. This paper discusses how tungsten alloys have great potential for ultrahigh-temperature applications because of their thermal capabilities and exceptional high-temperature mechanical properties. Recent investigations of second-phase particle-strengthened W-Re alloys show that fine HfC and ThO_2 particles significantly improve the high-temperature tensile and creep properties of tungsten alloys. The superior high-temperature strengths of these alloys above 2,000 K are attributed to the strong interaction between these second-phase particles and dislocations as well as excellent stability of these particles.

53244 Microstructures and mechanical properties of NiAl-Ni_2AlHf alloys. Takeyama, M. (National Research Institute for Metals, 2-3-12 Nakameguro, Meguro-ku, Tokyo 153 (Japan)); Liu, C.T. *Journal of Materials Research (USA)*, 5(6): 1189-1196 (Jun 1990). DOE Contract AC05-84OR21400.

The microstructure and mechanical properties of several Ni-Al-Hf alloys in the composition range between NiAl(β) and Ni_2AlHf (Heusler phase) have been studied. The volume fraction of Heusler phase, V_f, in these alloys varies from about 15 to 96%. The lattice misfit between the β and Heusler phases in two-phase alloys is larger than 5%, indicating no coherency between them. The yield strength increases with increasing V_f at all temperatures to 1000 °C. Compressive ductilities of 4 and 7% were obtained for the alloy with V_f of 15% at room temperature and 500 °C, respectively, but they decreased to 0% with increasing V_f to 96%. The corresponding fracture mode is basically transgranular cleavage. However, all the alloys can be deformed extensively without fracture at 1000 °C. The hardness of the Heusler alloy is very high (8.3 GPa) at room temperature, and it decreases gently with temperature to 600 °C, followed by a rapid decrease to 1000 °C. The brittleness and high hardness of the Ni_2AlHf Heusler phase at low temperatures are interpreted in terms of internal lattice distortion resulting from its crystal structure. The thermally activated process of deformation takes place above 600 °C, which is responsible for the rapid drop of the hardness of the alloys.

53245 Microstructure and tribology of laser mixed Fe/Ti/C multilayered films on AISI 304 stainless steel. Nastasi, M. (Materials Science and Technology Division, Los Alamos National Laboratory, Los Alamos, NM (USA)); Hirvonen, J.; Zocco, T.G.; Jervis, T.R. *Journal of Materials Research (USA)*, 5(6): 1207-1214 (Jun 1990).

An excimer laser was used to mix Fe/Ti/C multilayered films on 304 stainless steel substrates. The samples were processed at both 1.1 and 1.7 J/cm^2 with the number of pulses at each position varied between 1 and 10. Composition, microstructure, phase evolution, and tribological properties were observed to correlate with total laser fluence. Increases in Fe concentration from substrate interdiffusion and loss of C content were observed with increasing total laser fluence. The best tribological properties were observed in films possessing a combination of an amorphous or Fe_3C phase plus fine grain TiC following processing at low and intermediate total laser fluence. At higher total fluences a combination of α-Fe, Fe_3C, and fine grain TiC was observed along with degradation in the wear and friction properties. Under optimum laser processing conditions the modified surface had a friction coefficient under dry sliding conditions reduced by a factor of 2 relative to uncoated 304 stainless steel and was significantly more wear resistant. These improvements in wear and friction appear to be related to the reduced chemical reactivity of the amorphous and carbide phases and to the influence of microstructure on improved mechanical properties.

53246 Threshold displacement and interstitial-atom formation energies in Ni_3Al. Caro, A. (Paul Scherrer Institute, CH-5232 Villingen (Switzerland)); Victoria, M.; Averback, R.S. *Journal of Materials Research (USA)*, 5(7): 1409-1413 (Jul 1990). DOE Contract AC02-76ER01198.

Threshold displacement energies for atomic displacements along ⟨110⟩, ⟨100⟩ and ⟨111⟩ directions, and formation enthalpies of several symmetric interstitial atom configurations were calculated for Ni_3Al by computer simulation using "embedded atom method" potentials. The Ni-Ni(100) dumbbell in the plane containing only Ni atoms has the lowest interstitial-atom enthalpy although the enthalpies of other configurations are similar. Interstitial configurations involving Al atoms all have much higher enthalpies. The anisotropy of the threshold energies in Ni_3Al is similar to pure metals and no significant difference in threshold energy was observed for ⟨110⟩ replacement chains in rows containing all Ni atoms or alternating Ni-Al atoms. Various metastable interstitial atom configurations were observed, including crowd-ions. In addition, the spontaneous recombination volume for some configurations can be much smaller than in pure metals. The consequences of these results for radiation induced segregation and amorphization *are discussed.*

53247 Crystal to amorphous transformation of NiTi induced by cold rolling. Koike, J. (Center for Materials Science, Los Alamos National Laboratory, Los Alamos, NM (USA)); Parkin, D.M.; Nastasi, M. *Journal of Materials Research (USA)*, 5(7): 1414-1418 (Jul 1990). DOE Contract W-7405-ENG-36.

An NiTi intermetallic compound was cold rolled at room temperature by 30% and 60% thickness reductions, and microstructures were studied by means of transmission electron microscopy (TEM). In the cold-rolled samples we observed both a phase of nanometer-sized crystals and an amorphous phase. A substantially high dislocation density, 10^{13} to 10^{14}/cm^2, was evident in the transition region between crystalline and amorphous phases. A simple estimate of the elastic energy arising from this dislocation density is of the same order as the crystallization energy, suggesting that dislocation accumulation is a major driving force for amorphization in cold-rolled NiTi.

53248 Microstructure at the interface between AlN and a Ag-Cu-Ti braze alloy. Carim, A.H. (Department of Chemical and Nuclear Engineering, University of New Mexico, Albuquerque, NM (USA)); Loehman, R.E. *Journal of Materials Research (USA)*, 5(7): 1520-1529 (Jul 1990).

The joining of aluminum nitride by active metal brazing with a Ag-Cu-Ti foil has been investigated in cross-section by transmission electron microscopy. The reaction of AlN with the braze alloy results in the formation of continuous TiN and $(Ti,Cu,Al)_6N$ (η-phase) layers at the interface. AlN grains at the interface often display arrays of dislocations, presumably arising from thermal expansion mismatch between the AlN and the TiN (the coefficients of thermal expansion are 43×10^{-7}/°C and 80×10^{-7}/°C, respectively). The adjoining TiN contains small Cu precipitates and may also contain numerous defects. Titanium preferentially penetrates the AlN grain boundaries, resulting in finger-like TiN intrusions into the substrate, which sometimes cover entire AlN grains in a TiN shell. On the other side of the TiN, a continuous layer of equiaxed, defect-free η-nitride grains is found. Beyond this η-nitride layer is the remaining mixture of metallic Ag and Cu. High-resolution electron microscopy demonstrates that the AlN-TiN and TiN-η boundaries are abrupt and contain no additional crystalline or amorphous intervening phases. Particular orientation relationships are occasionally observed at the AlN-TiN interface; these are not always the ones that produce the minimum lattice mismatch.The implications of the observed morphology with respect to the reaction sequence, transitional phases, and structural integrity of the joint are discussed.

3602 Ceramics, Cermets, and Refractories

Refer also to citation(s) 52641, 53138, 53140, 53161, 53165, 53185, 53187, 53209, 53227, 53232, 53235, 53240, 53433, 53465, 53584, 54231, 54235

53249 (AD-A-223863/2/XAB) **Micromechanisms of fatigue crack growth and fracture toughness in metal-matrix composites. Final technical report, 1 August 1988-28 April 1990.** Davidson, D.L. Southwest Research Inst., San Antonio, TX (USA). 28 Jun 1990. 9p. Contract N00014-85-C-0206. Source: NTIS, PC A02/MF A01.

Research objectives under which this work was initiated were as follows: To understand the mechanisms of subcritical crack extension and fracture toughness in particulate-reinforced metal matrix composites projected for Naval applications in which one or more of these parameters control service. The factors thought to be important in 1985 were the processing variables by which these materials were fabricated and the role of SiC particles in altering fatigue crack growth and fracture toughness of the matrix alloys. The methods used in reaching for these objectives include the techniques of experimental micromechanics. Experiments in fatigue crack growth and fast fracture were conducted for a variety of composites obtained from different manufacturers, and these materials were thoroughly characterized. Materials characterized were picked in order to: (1) determine the effects of differences in matrix composition and heat treatment, (2) determine the effect of SiC volume fraction, and (3) account for differences in particle size. Materials were obtained from two different manufacturers. IN-9051+15v/o SiC (essentially Al-4Mg) and IN-9021+15v/o SiC, both made by mechanically alloying and powder metallurgy were obtained from Novamet. The remainder of the composites made by ingot metallurgy by Dural Aluminum Composites Co., were: Al-4Mg+15v/o SiC, 2014+15v/o SiC, 2014+25v/o SiC, 2024+15v/o, 2014+15v/o SiC, and 7475+15v/o SiC.

53250 (AD-A-224460/6/XAB) **Dynamic consolidation of super-hard materials. Technical report, 1 October 1988-31 December 1989.** Yang, W.; Bond, G.M.; Tan, H.; Ahrens, T.J.; Liu, G. California Inst. of Tech., Pasadena, CA (USA). Seismological Lab. 25 Jun 1990. 57p. Contract DAAL03-88-K-0199. Source: NTIS, PC A04/MF A01.

Shock consolidation experiments were conducted via flyer impact on synthetic diamond (6-12 microns) and cubic boron nitride (c-BN) (4-8 microns) admixed with SiC whisker, Si3N4 whisker, SiC powder and Si powder contained in stainless steel capsules in the shock pressure range 10-30 GPa. Scanning electron microscopy and transmission electron microscopy imaging of the samples revealed no plastic deformation or melting of diamond and virtually no deformation of c-BN, whereas the SiC and Si3N4 whiskers were extensively melted and recrystallized into bundle-shaped crystallites. In contrast, SiC powder mixed with diamond was also melted but demonstrated equant grain growth. A new mixture model of powder plus whisker materials is formulated on the basis of sphere-rod mixing and packing experiments. The model assigns excess porosity to the zone around whiskers and yields a better description of the energy deposition mechanism of the consolidation of powder-whisker systems. Some of the experiments employed Sawaoka's post-shock annealing technique, in which the sample is sandwiched between two layers of a mixture of titanium powder plus carbon. Very well consolidated samples were obtained with post-shock heating under shock pressures of only about 12 GPa.

53251 (AD-A-224462/2/XAB) **Extension of plasma-source ion implantation to ion-beam-enhanced deposition. Final report, 1 February-31 July 1989.** Conrad, J.R. Wisconsin Univ., Madison, WI (USA). 5 Oct 1989. 10p. Contract DAAL03-89-K-0048. Source: NTIS, PC A02/MF A01.

The specific plans consist of the following activities: optimize conditions for elevated temperature PSII-IBED of nitride coatings of Ti, Cr, Nb, V, and Zr on test flats to establish the effectiveness of PSII in performing ion beam enhanced deposition; characterize coatings thus developed using test procedures for evaluating the wear, friction, corrosion, and rolling contract fatigue behavior; demonstrate the capability of elevated temperature PSII-IBED on a prototype component, and evaluate its performance; modify and refine our existing Monte Carlo code (TAMIX, developed here) for simulating the elevated-temperature PSII-IBED process and benchmark the code to ensure its predictive capability; and develop a detailed plasma simulation model of PSII to generate realistic ion current and energy distributions of ions to the target (to be used as input to the TAMIX code).

53252 (AD-A-224529/8/XAB) **New resistance-measurement technique applicable to high-temperature superconducting materials at microwave frequencies.** Skrehot, M.K.; Chang, K. Texas A and M Univ., College Station, TX (USA). Dept. of Electrical Engineering. Apr 1990. 6p. Contract DAAL03-89-K-0085. Source: NTIS, PC A02/MF A01.

Pub. in IEEE Transactions on Microwave Theory and Techniques, Vol. 38, No. 4, 434-437(Apr 1990).

A two-gap electrically floating resonant strip is used for surface resistance measurements of the high-temperature superconductor, YBa2Cu3O(7-delta). The method used has the advantages of simplicity, no electrical contact, operation at various resonant frequencies, and of requiring only a small sample. An analysis was used that allows for the accurate design of the strip dimensions to produce a desired resonant frequency. Experimental measurements on resonant frequencies in X and Ku-band (8-18 GHz) agree well with the calculations. The method allows one to extract the normalized surface frequency. These normalized values were found to compare favorably to the Mattis-Bardeen theory taken in the local limit. The resonant strip in waveguide should have applications in high-temperature superconductive material characterization and in the development of waveguide superconductive filters.

53253 (CEA-CONF-10083) **Spin glass freezing and superconductivity in $YBa_2(Cu_{0.94}Fe_{0.06})_3O_7$.** Mirebeau, I. (Laboratoire Leon Brillouin, Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)); Hennion, M.; Dianoux, J.; Caignaert, V.; Moorjani, K. Laboratoire Leon Brillouin (LLB) - Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). 1989. 11p. (CONF-891117–: 34. conference on magnetism and magnetic materials, Boston, MA (USA), 28 Nov - 1 dec 1989). Order Number DE91716205. Source: NTIS (US Sales Only), PC A03/MF A01.

We have studied the dynamics of the iron spins in a superconducting $YBa_2(Cu_{0.94}Fe_{0.06})_3O_7$ sample by neutron time of flight measurements. The range of scattering vector q was $0.1 < Q < 2.1$ A^{-1}, and the energy resolution 80 μeV. The temperature was varied in the range $1.8\ K < T < 300\ K$. In the whole temperature range, the q-dependence of the magnetic intensity mainly reflects the magnetic form factor of iron which shows that the iron spins are almost uncorrelated. The elastic and quasielastic intensities strongly vary with temperature. A spin glass like freezing is revealed at low temperature by a sharp decrease of the quasielastic intensity, an increase of the elastic or resolution limited intensity and a minimum in the quasielastic width. The freezing temperature (T_f = 18 K) corresponds to that already determined by a magnetic splitting in Moessbauer experiments. Above T_f, the relaxation of the iron spins in the paramagnetic state is modified by the occurrence of superconductivity. We observe a slight increase of the quasielastic intensity and of the quasielastic width at the superconducting transition (T_c = 74 K), possibly related to the electron-spin coupling.

53254 (CEA-CONF-10088) **An investigation into texturing of high-Tc superconducting ceramics by creep-sintering.** Regnier, P.; Le Hazif, R.; Chaffron, L. CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Technologie. 1989. 6p. (CONF-891157–: International conference on superconductivity, Paris (France), 23-24 Nov 1989). Order Number DE91716204. Source: NTIS (US Sales Only), PC A02/MF A01.

The possibility of preparing highly textured samples of $YBa_2Cu_3O_{7-x}$ high-Tc ceramics by creep-sintering under an uniaxial stress was investigated in detail. It is shown that the quality of the texture is sharply dependant on: the applied load, the temperature of the sintering dwell, the rate at which this dwell is reached, the exact instant at which the load is applied and the nature of the material in contact with the sample. It is also shown that further annealing without applied stress enhances the texture and considerably increases the grain size. Deformation, which was systematically recorded, occurs within a few minutes after the load is applied and exhibits a stress dependance typical of a viscous flow. Systematic examination by polarized light microscopy has indicated that the texture was homogeneous throughout the whole thickness of all the prepared samples. The resistivity versus temperature curves show that the transition is very sharp and well above 77 K.

53255 (CEA-CONF-10123) **Positron studies in as received and electron irradiated $YBa_2Cu_3O_{6.9}$, $DyBa_2Cu_3O_{6.9}$ and $CaSr_2Bi_2Cu_2O_{8-x}$.** Moser, P.; Henry, J.Y. CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France). Dept. de Recherche Fondamentale. 1988. 3p. (CONF-8808122--: 8. international conference on positron annihilation, Gent (Belgium), 29 Aug - 3 sep 1988). Order Number DE91716211. Source: NTIS (US Sales Only), PC A02/MF A01.

The temperature dependence of the positron annihilation parameters is measured between 77K and 300K in different oxide superconductors before and after electron irradiation. Before irradiation a reproducible behaviour is observed in $YBa_2Cu_3O_{6.9}$ and $DyBa_2Cu_3O_{6.9}$: a maximum of the positron lifetime and Doppler broadening is found at 150K suggesting that positrons are trapped in a well defined charged defect identified as the [Cu(1),nO] polyvacancy, with n=1 or 2. After electron irradiation, an increase in positron lifetime is found, which disappears by annealing between 100K and 500K.

53256 (CNIC-00359) **Study of Zr-4 plates for fuel racks.** China Nuclear Information Centre, Beijing, BJ (China). Oct 1989. 7p. (In Chinese). (NINF-0004). Order Number DE91605651. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

In the preparation of Zr-4 alloy plates, which are used for fuel racks, the effects of adopted process on their machanical properties are studied. The optimum process is determined for meeting the designing requirements of fuel racks. The process begins with ingots, then β forging, β quenching, α hot rolling, cold rolling and annealing. In addition, the maxmum tension stress would increase 10% if another β quenching is taken before the cold rolling.

53257 (CONF-9010193--1) **Cooperative international program on mechanical strength measurements of ceramics.** Tennery, V.J.; Ferber, M.K. Oak Ridge National Lab., TN (USA). [1990]. 38p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC05-84OR21400. From Annual automotive technology development contractor coordination meeting; Dearborn, MI (USA); 22-25 Oct 1990. Order Number DE91000102. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This report consists of viewgraphs for the presentation on the cooperative international program on mechanical strength measurements of ceramics for advanced heat engines. (JDL)

53258 (DOE/ER/13433--T1) **Analytical and experimental studies for thermal plasma processing of materials: Progress report, September 1, 1988--May 31, 1990.** Minnesota Univ., Minneapolis, MN (USA). Dept. of Mechanical Engineering. [1990]. 8p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-85ER13433. Order Number DE91000599. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Work continued on thermal plasma processing of materials. This quarter, ceramic powders of carbides, aluminium nitride, oxides, solids solutions, magnetic and non magnetic spinels, superconductors, and composites have been successfully synthesized in a Triple DC Torch Plasma Jet Reactor (TTPR) and in a single DC Plasma Jet Reactor. All the ceramic powders with the exception of AlN were synthesized using a novel injection method developed to overcome the problems associated with solid injection, in particular for the single DC plasma jet reactor, and to realize the benefits of gas phase reactions. Also, initial experiments have been performed for the deposition of diamond coatings on Si wafers using the TTPR with methane as the carbon source. Well faceted diamond crystallites were deposited on the surface of the wafers, forming a continuous one particle thick coating. For measuring temperature and velocity fields in plasma systems, enthalpy probes have been developed and tested. The validity has been checked by performing energy and mass flux balances in an argon plasma jet operated in argon atmosphere. Total Gibbs free energy minimization calculations using a quasi-equilibrium modification have been applied to simulate several chemical reactions. Plasma reactor modelling has been performed for the counter-flow liquid injection plasma synthesis experiment. Plasma diagnostics has been initiated to determine the pressure gradient in the coalesced part of the plasma jet. The pressure gradient drives the diffusion of chemical species which ultimately controls the chemical reactions. 4 figs.

53259 (DOE/ER/45051--3) **Fracture toughness of materials: Final report, February 1984--September 1988.** Burns, S.J. Rochester Univ., NY (USA). Dept. of Mechanical Engineering. [1988]. 13p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-84ER45051. Order Number DE91001305. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Crack tip dislocation emission in bulk specimens have been measured in single crystal specimens and the measurements are well below the accepted theoretical values for dislocation emission. The image forces on a dislocation due to the presence of a semi-infinite crack are used to calculate the potential energy of the dislocation around the crack. Expressions for the radial and tangential forces and for slip and climb forces have been found. Crack tip deformation in Mode I and Mode II fractures on both {100} and {110} planes have been observed in crystals of LiF. The deformation is shown to nearly completely shield {110} plane cracks and prevent their propagation while deformation is less effective in shielding {100} plane cracks. The fracture toughness of MgO-partially-stabilized ZrO_2 exhibiting transformation toughening been measured. The equations of linear elastic fracture mechanics have been self-consistantly formulated to include the residual displacement from the transformation wake. MgO single crystals were fatigued in plastic strain control at elevated temperatures. At high temperatures, dense bundles of dislocations were observed in transmission electron microscopy aligned perpendicular to the Burgers' vector directions. The thermodynamics of a superconducting second order phase transformation has been related to jumps in physical properties. A simple energy balance, without assuming an equation of state, is used to relate the rate of change of state variables to measurable physical properties. There are no preconceived assumptions about the superconducting mechanism.

53260 (DOE/ER/45297--24) **Artificially structured magnetic materials: Technical progress report, April 1, 1990--September 30, 1990.** Falco, C.M. Arizona Univ., Tucson, AZ (USA). 28 Sep 1990. 11p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-87ER45297. Order Number DE91000600. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This document reports the progress made during the first six months of the current three-year DOE grant on "Artificially Structured Magnetic Materials." However, because some of the results of our previous three-year DOE grant on "Artificially Structured Superconductors" continue to emerge, both topics are addressed in this Progress Report. This report describes progress with DOE funding during the current calendar year; description of the research to be conducted during the remaining six months of the current grant year; a description of the status of the graduate students working on this research; lists of the invited talks, seminars and colloquia, of other recognition of our research, and of the publications crediting DOE sponsorship; and a summary of current and pending federal support. Since the research proposed to be conducted during the next 2 1/2 years is described in detail in our DOE proposal, it is only briefly reviewed here.

53261 (LA-11918-MS) **New multiphase equation of state for polycrystalline quartz.** Boettger, J.C.; Lyon, S.P. Los Alamos National Lab., NM (USA). Oct 1990. 14p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-36. Order Number DE91001048. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

We have generated separate equations of state (EOS's) for the alpha quartz, coesite, and stishovite phases of polycrystalline quartz (SiO_2) using the computer program GRIZZLY. We also modified the program GRIZZLY to combine two single-phase EOS's for a given material into a single two-phase EOS via minimization of the Gibbs free energy. This new version of GRIZZLY has been used to generate a three-phase SESAME type EOS for polycrystalline quartz using the three EOS's mentioned above. All four of the EOS's produced for SiO_2 are now available on request. 17 refs., 4 figs., 1 tab.

53262 **High temperature superconductivity: Proceedings.** Bedell, K.S. (Los Alamos National Lab., NM (USA)); Coffey, D.; Meltzer, D.E.; Pines, D.; Schrieffer, J.R. 474p. Addison-Wesley Publishing Company, Redwood City, CA (1990). Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-36.

(CONF-891274–: 1989 symposium on high temperature superconductivity, Los Alamos, NM (USA), 6-9 Dec 1989).

This book is the result of a symposium at Los Alamos in 1989 on High Temperature Superconductivity. The topics covered include: phenomenology, quantum spin liquids, spin space fluctuations in the insulating and metallic phases, normal state properties, and numerical studies and simulations. (JF)

53263 (ORNL/FTR–9783) **[Optical characterization techniques applied to ceramic oxides]: Foreign trip report, October 1, 1989–September 28, 1990.** Abraham, M.M. Oak Ridge National Lab., TN (USA). 15 Oct 1990. 8p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE91001526. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The traveler collaborated with M.J.M. Leask, J.M. Baker, B. Bleaney, and others at the Clarendon Laboratory, Oxford University, Oxford, UK, to Study Tetragonal rare-earth phosphates and vanadates by optical and magnetic spectroscopy. This work is related to similar studies that have been performed at ORNL by the Synthesis and Properties of Novel Materials Group in the Solid State Division.

53264 (ORNL/Sub–87-SB047C/1) **Analytical and experimental evaluation of joining silicon nitride to metal and silicon carbide to metal for advanced heat engine applications: Final report, Phase 1.** Kang, S. (GTE Labs., Inc., Waltham, MA (USA)); Selverian, J.H.; Kim, H.; O'Niel, D.; Kim, K. Oak Ridge National Lab., TN (USA); GTE Labs., Inc., Waltham, MA (USA). Apr 1990. 141p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC05-84OR21400. Order Number DE91000535. Source: NTIS, PC A06/MF A01 - OSTI; GPO Dep.

This report summarizes the results of Phase I of Analytical and Experimental Evaluation of Joining Silicon Nitride to Metal and Silicon Carbide to Metal and Silicon Carbide to Metal for Advanced Heat Engine Applications. A general methodology was developed to optimize the joint geometry and material systems for 650 and 950°C applications. Failure criteria were derived to predict the fracture of the braze and ceramic. Extensive finite element analyses (FEA), using ABAQUS code, were performed to examine various joint geometries and to evaluate the affect of different interlayers on the residual stress state. Also, material systems composed of coating materials, interlayers, and braze alloys were developed for the program based on the chemical stability and strength of the joints during processing and service. Finally, the FEA results were compared with experiments using an idealized strength relationship. The results showed that the measured strength of the joint reached 30–90% of the strength by predicted by FEA. Overall results demonstrated that FEA is an effective tool for designing the geometries of ceramic-metal joints and that joining by brazing is a relevant method for advanced heat engine applications. 33 refs., 54 figs., 36 tabs.

53265 (ORNL/TM–11522) **New materials for thick-film electronics.** Hoffheins, B.S.; Lauf, R.J. Oak Ridge National Lab., TN (USA). Aug 1990. 32p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE91000518. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Certain ceramic compounds such as rare-earth perovskites and transition-metal diborides that exhibit metallic conductivity are readily available or can be easily synthesized. Some are stable in air firing temperatures typical of hybrid-circuit processing. The work described is part of an exploratory program to determine whether these materials can be used as low-cost alternatives to precious metals for thick-film conductor and low-resistor inks or as substitutes for copper in nitrogen-fireable compositions. 8 refs., 13 figs., 3 tabs.

53266 (PNL-SA–18319) **Consolidation of colloidal suspensions.** Shih, Wei-Heng (Washington Univ., Seattle, WA (USA)); Kim, Seong Il; Shih, Wan Y.; Aksay, I.A.; Schilling, C.H. Pacific Northwest Lab., Richland, WA (USA). Aug 1990. 10p. Sponsored by U.S. DOE Energy Research. DOE Contract AC06-76RL01830. (CONF-900466–88: Spring meeting of the Materials Research Society, San Francisco, CA (USA), 16-21 Apr 1990). Order Number DE91000415. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

A key step in the processing of ceramics is the consolidation of powders into engineered shapes. Colloidal processing uses solvents (usually water) and dispersants to break up powder agglomerates in suspension and thereby reduce the pore size in a consolidated compact. However, agglomeration and particle rearrangement leading to pore enlargement can still occur during drying. Therefore, it is beneficial to consolidate the compact as densely as possible during the suspension stage. The consolidation techniques of pressure filtration and centrifugation were studied and the results are reported in this paper. In particular, the steady-state pressure- density relationship was studied, and information was obtained regarding the consolidation process, the microstructure, and the average density profile of consolidated cakes. Recently, we performed Monte Carlo simulations on a cluster-cluster aggregation model with restructuring, and found the exponential relationship between pressure and density is indeed the result of the breaking up of the fractal structural units. Furthermore, we calculated density profiles from the bottom to the top of the consolidated cakes by solving the local static force balance equation in the continuum particulate network. 11 refs., 3 figs.

53267 (SAND–90-1094C) **Irradiation-induced pinning in single-crystal and thin-film $Tl_2Ca_2Ba_2Cu_3O_{10}$ superconductors.** Barbour, J.C.; Venturini, E.L.; Ginley, D.S. Sandia National Labs., Albuquerque, NM (USA). [1990]. 15p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-900936–14: 7. international conference on ion beam modification of materials, Knoxville, TN (USA), 9-14 Sep 1990). Order Number DE91001342. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Magnetization relaxation measurements were used to directly measure the effects of ion irradiation on magnetic flux pinning. The pinning potential (U) in a $Tl_2Ca_2Ba_2Cu_3O_y$ single crystal irradiated with 4.5 MeV protons, to a damage level of 4×10^{-4} dpa, increased by ≈25% at 25 K. In contrast, U for a highly oriented polycrystalline thin film irradiated with 300 keV He ions to a damage level of 2×10^{-4} dpa increased by only 5% at 25 K (and less at higher temperatures). Enhancement of the magnetization critical current density (J_{cm}) is determined as a function of temperature and damage in the single crystal and thin film. High energy proton irradiation increased J_{cm} in the single crystal by an order of magnitude at 25 K but had only a small effect on J_{cm} in the thin film. 13 refs., 4 figs.

53268 **A small angle neutron scattering investigation of compacted nanophase TiO_2 and Pd.** Eastman, J.A. (Materials Science Div., Argonne National Lab., Argonne, IL (US)); Liao, Y.X.; Narayanasamy, A.; Epperson, J.E.; Siegel, R.W.; White, J.W. pp. 87-94 of Neutron scattering for materials science. Materials Research Society proceedings: Volume 166. Shapiro, S.M.; Moss, S.C.; Jorgensen, J.D. Materials Research Society, Pittsburgh, PA (USA) (1990). pp. 499 (CONF-891119–: Materials Research Society fall meeting, Boston, MA (USA), 27 Nov - 2 dec 1989).

Nanocrystalline compacts of TiO_2 and Pd were prepared by first condensing the Ti or Pd vapors in an inert gas atmosphere. The Ti was oxidized in situ to TiO_2. Samples were prepared by scraping off the compacting the nanophase materials into thin disks. The small angle neutron scattering was measured in the as-prepared condition and after isothermal anneals of up to 23 hrs at 550°C for the TiO_2 and up to 3.3 hrs at 300°C for the Pd. Scattering data were obtained in absolute cross sections. Integrated small angle scattering and maximum entropy methods were used in estimating the structural parameters. The results are interpreted in terms of a model which consists of nanometer sized grains of the materials separated by boundary regions which are, on average, much less dense than the respective bulk materials; 21% for the TiO_2 and about 56% for Pd. However, the boundary regions contain voids or pores, which contribute to these density decrements. Possible sources of error are discussed.

53269 **Use of neutron diffraction in determining strains in high-temperaure superconducting composites.** Hitterman, R.L. (Materials Science Division, Argonne National Lab., Argonne, IL (US)); Faber, J. Jr.; Kupperman, D.S.; Singh, J.P.; Majumdar, S. pp. 195-202 of Neutron scattering for materials science. Shapiro, S.M.; Moss, S.C.; Jorgensen, J.D. Materials Research Society,

Pittsburgh, PA (USA) (1990). pp. 499 (CONF-891119--: Materials Research Society fall meeting, Boston, MA (USA), 27 Nov - 2 dec 1989).

The Argonne Intense Pulsed Neutron Source and General Purpose Powder Diffractometer have been used to study high T_c metal oxide composites composed of yttrium barium copper oxide and silver. Neutron diffraction techniques were applied to composites with 15, 20 and 30% silver content by volume. The authors have observed that after hot pressing, the 30% Ag specimens contained both orthorhombic high T_c and tetragonal, non-superconducting phases near the center of the specimens but only tetragonal near the surface. The relationship of shifts in Bragg peaks to strains of the constituents is discussed.

53270 The effect of hydrogen on the charge states of oxygen vacancies in thermochemically reduced alkaline-earth oxides. Chen, Y.; Orera, V.M.; Gonzalez, R. Williams, R.t.; Williams, G.P.; Rosenblatt, G.H. pp. 286-286 of Optical materials: Volume 152. Poker, D.B.; Ortiz, C. Materials Research Society, Pittsburgh, PA (USA) (1989). pp. 298 (CONF-8904283--: Optical materials: processing and science, San Diego, CA (USA), 24-26 Apr 1989).

To a greater or lesser extent, all alkaline-earth oxide crystals contain hydrogen. Thermochemical reduction (TCR) of MgO and CaO crystals at high temperatures (~2000K) and high pressures (4 to 7 atmospheres) of the metallic cation vapor (Mg and Ca respectively) results in a stoichiometric deficiency of oxygen ions, creating F centers (oxygen vacancies each with two electrons) and H_- ions (protons in the anion sublattice, each occupied by two electrons)> The positively-charged H^- ions serve as traps for electrons excited from the F centers. Steady-state photo-excitation of the F absorption band results in F luminescence which typically extends to several minutes. This photoluminescence is detrimental for certain applications, such as tunable lasers. The authors have been able to reduce the hydrogen concentration prior to TCR of MgO and during TCR of CaO. The result is that the oxygen vacancies are predominately in the one-electron F_+ charge state.

53271 Microstructures and properties of SiC whisker-reinforced mullite composites. Tiegs, T. (Oak Ridge National Lab., Oak Ridge, TN (US)); Becher, P.; Angelini, P. pp. 463-472 of Mullite and mullite matrix composites: Volume 6. Burger, H.G.; Findlay, J.K.; de Kretser, D.M.; Igarashi, M. American Ceramic Society Inc., Columbus, OH (USA) (1990). pp. 649 DOE Contract AC05-84OR21400. (CONF-871189--: 1. international conference on mullite, Tokyo (Japan), 9-10 Nov 1987).

Mullite is an attractive material for certain structural applications because of its excellent phase stability, low thermal conductivity, excellent creep resistance, and high temperature strength retention as compared to other engineering ceramic materials. However, mullite suffers from low strength and fracture toughness. Results at Oak Ridge National Laboratory show significant improvement in both strength and toughness of mullite with the addition of SiC whiskers. Typically, monolithic mullite has strength and toughness values of 200 MPa and 2.2 $MPa\sqrt{m}$, respectively. With the addition of 20 vol.% SiC whiskers the corresponding values are increased to 425 MPa and 4.7 $mpa\sqrt{m}$. The improved strength is retained up to elevated temperatures, however, at temperatures greater than 1200°C the strength is dependent on the secondary phases present at the grain boundaries.

53272 Electronic structure of monoclinic $BaBiO_3$. Shen, Z. (Stanford Electronics Laboratories, Stanford University, Stanford, CA (USA)); Lindberg, P.A.P.; Wells, B.O.; Dessau, D.S.; Borg, A.; Lindau, I.; Spicer, W.E.; Ellis, W.P.; Kwei, G.H.; Ott, K.C.; Kang, J.; Allen, J.W. *AIP Conference Proceedings (American Institute of Physics) (USA),* 199(1): 30-35 (25 Jan 1990). DOE Contract AC03-82ER13000. (CONF-891092--: 3. annual topical conference on high $T_c$superconducting thin films: processing, characterization, and applications, Boston, MA (USA), 23-27 Oct 1989).

We present the results of photoemission studies of "valence disordered" monoclinic $BaBiO_3$ in the photon energy range 15–120 eV. The line-shapes of the valence band photoemission spectra and the Ba contributions to the valence band are very similar to the line shapes of the total density of states and Ba partial density of states, respectively. Oxygen resonance is observed, demonstrating the existence of empty O 2p states. These results support a more covalent rather than a simple ionic picture for the electronic states of $BaBiO_3$.

53273 Nature of the valence band states in $Bi_2(Ca, Sr, La)_3Cu_2O_8$. Wells, B.O. (Stanford Electronics Laboratories, Stanford University, Stanford, CA (USA)); Lindberg, P.A.P.; Shen, Z.; Dessau, D.S.; Spicer, W.E.; Lindau, I.; Mitzi, D.B.; Kapitulnik, A. *AIP Conference Proceedings (American Institute of Physics) (USA),* 199(1): 36-41 (25 Jan 1990). DOE Contract AC03-82ER13000. (CONF-891092--: 3. annual topical conference on high $T_c$superconducting thin films: processing, characterization, and applications, Boston, MA (USA), 23-27 Oct 1989).

We have used photoemission spectroscopy to examine the symmetry of the occupied states of the valence band for the La doped superconductor $Bi_2(Ca, Sr, La)_3Cu_2O_8$. While the oxygen states near the bottom of the 7 eV wide valence band exhibit predominantly O $2p_z$ symmetry, the states at the top of the valence band extending to the Fermi level are found to have primarily O $2p_x$ and O $2p_y$ character. We have also examined anomalous intensity enhancements in the valence band feature for photon energies near 18 eV. These enhancements, which occur at photon energies ranging from 15.8 to 18.0 eV for the different valence band features, are not consistent with either simple final state effects or direct O2s transitions to unoccupied O2p states.

53274 Oxygenation and possible etching of high T_c superconducting films by oxygen plasma. Ruckman, M.W. (Department of Applied Science, Brookhaven National Laboratory, Upton, NY (USA)); Budhani, R.C.; Qui, S.L. *AIP Conference Proceedings (American Institute of Physics) (USA),* 199(1): 114-121 (25 Jan 1990). DOE Contract AS05-80ER10742 ;AC02-76CH00016. (CONF-891092--: 3. annual topical conference on high $T_c$superconducting thin films: processing, characterization, and applications, Boston, MA (USA), 23-27 Oct 1989).

The use of a radio frequency (RF) excited oxygen plasma for cleaning and oxygenation of high T_c superconducting films at room temperature is studied by photoemission spectroscopy. Plasma oxidation at ~10 mT pressure, removes comtaminants like carbon and causes the Ba 5p and 4d and the 0 ls corelevels to shift to lower binding energy. Valence band spectra for an epitaxial $Y_2Ba_4Cu_8O_{15+x}$ film on $SrTiO_3$ (001) show a Fermi edge and resemble spectra presented by other groups for $YBa_2Cu_3O_7$ single crystals and epitaxial films. These films also show a sharp 0 ls corelevel near 528 eV. Possible reactive ion etching of a degraded YBCO film surface is demonstrated in a series of spectra taken after successive oxygen plasma treatments. A surface contaminated with $BaCO_3$ becomes barium deficient after the initial plasma treatment but a second plasma treatment of a substrate biased to −200 V to promote sputtering produces photoemission features typical of an $YBa_2Cu_3O_7$ surface.

53275 Polarized copper *K*-edge x-ray-absorption spectra in $YBa_2Cu_3O_{7-y}$. Guo, J. (Department of Physics and Astronomy, Northwestern University, Evanston, IL (USA)); Ellis, D.E.; Alp, E.E.; Goodman, G.L. *Physical Review, B: Condensed Matter (USA),* 42(1): 251-265 (1 Jul 1990). DOE Contract W-31109-ENG-38.

The polarized copper *K*-edge x-ray-absorption near-edge spectra (XANES) in the high-$T_c$superconductor $YBa_2Cu_3O_7$ and related semiconductor oxide $YBa_2Cu_3O_6$ were calculated. The initial states and the final bound states were obtained from the self-consistent-field discrete-variational $X\alpha$ method (SCF DV-$X\alpha$). Continuum states were found by the multiple-scattering method using the muffin-tin truncation of the SCF DV-$X\alpha$ potentials. XANES for each of the two Cu sites in these compounds were identified by using the calculated difference in Cu 1*s* ionization potentials. Features in XANES were interpreted with the help of the projected density of states and photoelectron trapping times. A quantitative comparison with the measured spectra leads us to assign shakedown features with relaxation energy of 8.3 eV and intensities of 20% and 12% of the total transition in the *a*-axis- and *b*-axis-polarized Cu *K*-edge XANES of $YBa_2Cu_3O_7$, respectively. This shakedown feature apparently involves ligand→3*d* transitions in the core-hole excited state. It is found that this relaxation process is present in the metallic $YBa_2Cu_3O_7$ and absent in the semiconducting phase.

53276 Analysis of the $YBa_2Cu_3O_7/SrTiO_3$ interface as a function of post-deposition annealing temperature. Asher, S.E. (Solar Energy Research Institute, Golden, CO (USA)); Nelson, A.J.; Mason, A.R.; Swartzlander, A.B.; Dhere, R.; Kazmerski, L.L.; Halbritter, J.; Harvey, T.E.; Beall, J.A.; Ono, R.H. *AIP Conference Proceedings (American Institute of Physics) (USA),* 199(1): 205-211 (25 Jan 1990). DOE Contract AC02-83CH10093. (CONF-891092--: 3. annual topical conference on high $T_c$superconducting thin films: processing, characterization, and applications, Boston, MA (USA), 23-27 Oct 1989).

A multiple technique approach is used to study $YBa_2Cu_3O_7$ grown on $SrTiO_3$ as a function of post-deposition annealing temperature. X-ray diffraction data are used to determine the relative amounts of a-axis and c-axis oriented growth. These results are compared to the surface morphology of the films observed by SEM. Secondary ion mass spectrometry (SIMS) is used to study the diffusion of substrate elements into the YBCO films as a function of post-deposition annealing temperature. The data obtained from all these techniques are correlated to determine an optimized temperature for post-deposition annealing. The results of this study show that the desired c-axis oriented growth can be obtained with minimal diffusion of substrate elements into the film at annealing temperatures of 750 °C.

53277 Cyclic fatigue-crack propagation in magnesia-partially-stabilized zirconia ceramics. Dauskardt, R.H. (Lawrence Berkeley Lab., Berkeley, CA (US)); Ritchie, R.O.; Marshall, D.B. *American Ceramic Society Bulletin (USA),* 73(4): 893-903 (Apr 1990). DOE Contract AC03-76SF00098.

The subcritical growth of fatigue cracks under (tension-tension) cyclic loading is demonstrated for ceramic materials, based on experiments using compact C(T) specimens of a MgO-partially-stabilized zirconia (PSZ). Under variable-amplitude cyclic loading, crack-growth rates show transient accelerations following low-high block overloads and transient retardations following high-low block overloads or single tensile overloads, again analogous to behavior commonly observed in ductile metals. Possible mechanisms for cyclic crack advance in ceramic materials are examined, and the practical implications of such ceramic fatigue are briefly discussed.

53278 Hot corrosion of silica. Lawson, M.G. (Materials Science and Engineering, Univ. of Pittsburgh, Pittsburgh, PA (US)); Kim, H.R.; Pettit, F.S.; Blachere, J.R. *American Ceramic Society Bulletin (USA),* 73(4): 989-995 (Apr 1990).

The high-temperature corrosion of bulk silica glass was studied in pure oxygen and in SO_3-containing oxygen atmospheres in the presence of liquid sulfate deposits at temperatures of 700° and 1000°C. No reaction and devitrification were observed without Na_2SO_4 on the surface. The wetting of the silica by the sulfate, the tendency toward basic fluxing, and the crystallization of the silica increased with the activity of Na_2O. The most extensive degradation of vitreous silica occurred by crystallization, and the resulting spalling under basic conditions and thermal cycling at basic conditions were parabolic. This behavior is explained by a model in which the crystallization is controlled by sodium at the glass-crystal interface and its diffusion into the glass. This sodium diffused into the glass before crystallization and is swept ahead of the crystallization front.

53279 Grain boundaries in silicon from zero temperature through melting. Phillpot, S.R. (Materials Science Div., Argonne National Lab., Argonne, IL (US)); Wolf, D. *American Ceramic Society Bulletin (USA),* 73(4): 933-937 (Apr 1990). DOE Contract W-31-109-ENG-38.

The results of atomistic simulations of twist grain boundaries in covalent silicon are presented and compared with similar studies in metals. Three aspects are discussed in detail: the zero-temperature structure-energy correlation, the elastic anomalies near a twist boundary at zero temperature and the high-temperature stability of a boundary and its role in thermodynamic melting. In each case sticking similarities with studied on metals are found, which are attributed to the important role played at atoms in close proximity. By contrast the covalent nature of bonding in silicon appears to play only a minor role.

53280 Polarization x-ray-absorption near-edge structure study of $Pr_{2-x}Ce_xCuO_4$ single crystals: The nature of Ce doping. Tan, Z. (Department of Physics, University of Connecticut, Storrs, CT (USA)); Budnick, J.I.; Bouldin, C.E.; Woicik, J.C.; Cheong, S.; Cooper, A.S.; Espinosa, G.P.; Fisk, Z. *Physical Review, B: Condensed Matter (USA),* 42(1): 1037-1040 (1 Jul 1990). DOE Contract AS05-80ER10742.

A polarization Cu *K*-edge x-ray-absorption near-edge structure (XANES) study has been carried out on $Pr_{2-x}Ce_xCuO_4$ single crystals. The spectra for x-ray polarization vector **E** nearly parallel to the crystal *c* axis suggest that electrons contributed by Ce doping are initially localized at the Cu site. The spectra for **E** perpendicular to the *c* axis exhibit an almost rigid edge shift to lower energies upon Ce doping. This suggests that the unoccupied in-plane Cu 4*p* states shift to lower energies. Therefore, the Ce doping donates electrons to the Cu site and also shifts the unoccupied 4*p* band. We propose that the upper unoccupied band consisting of predominantly Cu 3*d* states shifts downward and eventually joins the initially localized states near the Fermi level and thus, forms the conduction band in the *n*-type superconductor.

53281 Measurement of infrared spectra of dense ceramics by specular reflectance spectroscopy. Bliss, M. (Materials Research Lab., Pennsylvania State Univ., University Park, PA (US)); Walden, B.L.; White, W.B. *American Ceramic Society Bulletin (USA),* 73(4): 1078-1083 (Apr 1990).

It is shown that high-quality IR specular reflectance spectra can be obtained from polished surfaces of dense ceramics. The reflectance spectra can be deconvoluted by the Kramers-Kronig transformation to yield absorption spectra or the real and imaginary parts of the dielectric function. IR line shapes the peak wavenumbers are comparable to single-crystal data providing that the particle size is small compared with the IR wavelengths of interest. For noncubic structures, the spectra are a superposition of polarization components. Modes separated by less than a bandwidth are merged into a single band, thus limiting the resolution of the measurement procedure. Grain size effects were modeled using the spectra of single-crystal and polycrystalline quartz as an example.

53282 Solid-state epitaxial effects in structurally diphasic xerogel of $Pb(Mg_{1/3}Nb_{2/3})O_3$. Ravindranathan, P. (Materials Research Lab., Pennsylvania State Univ., University Park, PA (US)); Komarneni, S.; Roy, R. *American Ceramic Society Bulletin (USA),* 73(4): 1024-1025 (Apr 1990).

Lead magnesium niobate (PMN), $Pb(Mg_{1/3}Nb_{2/3})O_3$, with perovskite structure has been prepared using structurally diphasic PMN gels. The diphasic gels were made using various concentrations of perovskite PMN seeds. The unseeded gel calcined at 775°C for 2 h gave ~ 98% of perovskite PMN phase. The use of 1% PMN perovskite seed not only led to a pure perovskite phase but also lowered the crystallization temperature of these gels by about 75°C. These results show that isostructural seeding helps to lower the crystallization temperature of perovskite PMN phase.

53283 Grain growth in donor-doped $SrTiO_3$. Peng, C. (Materials Research Laboratories, Industrial Technology Research Institute, Hsinchu, Taiwan (Republic of China)); Chiang, Y. *Journal of Materials Research (USA),* 5(6): 1237-1245 (Jun 1990). DOE Contract FG02-87ER45307.

The Nb donor concentration and cation stoichiometry dependence of grain growth in $SrTiO_3$ has been studied. The so-called donor anomaly, where grain growth is enhanced at low donor but suppressed at high donor concentrations, is only observed in non-stoichiometric compositions with an excess of B-site cations. Scanning transmission electron microscopy (STEM) observations indicate that this phenomenon is entirely a result of changes in the distribution of residual silicate phases. Exaggerated grain growth at low donor concentrations results from the presence of a continuously wetting grain boundary silicate, whereas inhibited growth at higher donor concentrations occurs in microstructures where the silicate phase is non-wetting. In stoichiometric compositions, however, grain growth rates are both slower and independent of donor concentration. In this composition regime grain growth appears to be limited by solid solution drag. The presence of residual silicates

only in nonstoichiometric compositions implies a strong stoichiometry dependence of the silica solubility.

53284 Decomposition of $YBa_2Cu_3O_{7-x}$ during annealing in CO_2/O_2 mixtures. Gao, Y. (Materials Science Division, Science and Technology Center for Superconductivity, Argonne National Laboratory, Argonne, IL (USA)); Merkle, K.L.; Zhang, C.; Balachandran, U.; Poeppel, R.B. *Journal of Materials Research (USA)*, 5(7): 1363-1367 (Jul 1990). DOE Contract W-31109-ENG-38.

The stability of $YBa_2Cu_3O_{7-x}$ superconductors towards reactions with CO_2 in CO_2/O_2 gas mixtures has been studied during annealing at temperatures ranging from 600 °C to 950 °C. The results show that there are three different types of the reactions. The reaction products of these reactions all include $BaCO_3$ and CuO, while the third product is dependent on the annealing temperature. At 600 °C, YBa-carbonates were formed while $Y_2Cu_2O_5$ and Y_2BaCuO_5 were formed at 815 °C and 950 °C, respectively. Transmission Electron Microscopy images show that the reactions started at grain boundaries with the formation of island-type precipitates.

53285 TEM studies on twin boundary in $YBa_2Cu_3O_7$ and $YBa_2(Cu_{0.98}M_{0.02})_3O_7$ (M=Zn, Al). Zhu, Y. (Department of Applied Science, Brookhaven National Laboratory, Upton, New York 11973 (USA)); Suenaga, M.; Xu, Y. *Journal of Materials Research (USA)*, 5(7): 1380-1387 (Jul 1990). DOE Contract AC02-76CH00016 ;AC03-76SF00098.

High resolution electron microscopy of the twin boundary layers in $YBa_2(Cu_{1-x}M_x)_3O_{7+\delta}$ for x=0 and 0.02 and M=Zn and Al showed that the boundary widths are ~1 nm for the pure and the Zn substituted $YBa_2Cu_3O_7$ and ~3 nm for the Al substituted oxide. From two beam contract studies and the high resolution images, it was concluded that the respective lattice plane across the boundary is shifted by $(1/3-\frac{1}{2})\cdot 2d_{(110)}$ along the boundary. The broadening of the layer by the Al substitution is also thought to be a cause for the reduction of the twin boundary energy leading to an increased twin density.

53286 Microstructural development in the near surface region during thermal annealing of Al_2O_3 implanted with cationic impurities. Farlow, G.C. (Wright State University, Dayton, Ohio 45435 (USA)); Sklad, P.S.; White, C.W.; McHargue, C.J. *Journal of Materials Research (USA)*, 5(7): 1502-1519 (Jul 1990). DOE Contract AC05-84OR21400.

Single-crystal Al_2O_3 was implanted with cationic impurities in the dose range $1–4\times10^{16}/cm^2$ and subsequently annealed in either an oxidizing or reducing environment. Following annealing at 1200 °C or higher crystalline precipitates or solid solutions are observed which are consistent with what is expected from the equilibrium phase diagram.

53287 Determining thin film properties by fitting optical transmittance. Klein, J.D. (EIC Laboratories, Norwood, Massachusetts 02062 (USA)); Yen, A.; Cogan, S.F. *Journal of Applied Physics (USA)*, 68(4): 1825-1830 (15 Aug 1990). DOE Contract AC03-87SF16733.

The optical transmission spectra of rf sputtered tungsten oxide films on glass substrates were modeled to determine absorption edge behavior, film thickness, and index of refraction. Removal of substrate reflection and absorption phenomena from the experimental spectra allowed direct examination of thin film optical characteristics. The interference fringe pattern allows determination of the film thickness and the dependence of the real index of refraction on wavelength. Knowledge of the interference fringe behavior in the vicinity of the absorption edge was found essential to unambiguous determination of the optical band gap. In particular, the apparently random deviations commonly observed in the extrapolation of as-acquired data are eliminated by explicitly considering interference fringe phenomena. The multivariable optimization fitting scheme employed allows air-film-substrate reflection losses to be compensated without making reflectance measurements.

53288 Steel for gears, having high strength. Dunmead, S.D.; Holt, J.B.; Kingman, D.D.; Munir, Z.A. To Dept. of Energy, Washington, DC (USA). USA Patent 4,946,643/A/. 7 Aug 1990. Filed date 26 Sep 1989. USA Patent patents application 7-412,973. Int. Cl. B22F 1/00. 10p. Source: Patent and Trademark Office, Box 9, Washington, DC 20232 (USA).

This patent describes dense, finely grained composite materials comprising one or more ceramic phase or phase and one or more metallic and/or intermetallic phase or phases are produced by combustion synthesis. Spherical ceramic grains are homogeneously dispersed within the matrix. Methods are provided, which include the step of applying mechanical pressure during or immediately after ignition, by which the microstructures in the resulting composites can be controllably selected.

53289 Method of processing materials using an inductively coupled plasma. Hull, D.E.; Bieniewski, T.M. To U.S. Dept. of Energy, Washington, DC (USA). USA Patent 4,897,579/A/. 30 Jan 1990. Filed date 23 Dec 1988. USA Patent patents application 7-289,286. Int. Cl. H01J 7/24. 3p. Source: Patent and Trademark Office, Box 9, Washington, DC 20232 (USA).

This patent describes a method of making fine powder in a gas-free environment using an electrically conductive ceramic or metal starting material which is initially in solid form. It comprises: providing inductively coupled plasma apparatus; placing the starting material within the radiation shield; evacuating the tubular enclosure; heating the starting material by use of the induction coil to vaporize the starting material and to form a plasma from the resulting vapor; and utilizing a powder collection surface adjacent to the outlet of the plasma apparatus to collect material emanating from the outlet.

3606 Other Materials

Refer also to citation(s) 52641, 52642, 52794, 52848, 52882, 52883, 52887, 52928, 52929, 52991, 53006, 53010, 53011, 53026, 53036, 53068, 53069, 53165, 53209, 53232, 53248, 53250, 53258, 53389, 53390, 53392, 53433, 53587, 53926, 54170, 54223, 54227, 54234

53290 (CEA-CONF–10121) **Positron trapping in electron irradiated CdTe and CdTe(In).** Moser, P. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France). Dept. de Recherche Fondamentale); Sen-Gupta, A. CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France). Dept. de Recherche Fondamentale. 1988. 3p. (CONF-8808122–: 8. international conference on positron annihilation, Gent (Belgium), 29 Aug - 3 sep 1988). Order Number DE91716213. Source: NTIS (US Sales Only), PC A02/MF A01.

CdTe and CdTe(In doped) were studied by positron annihilation techniques after a 2.5MeV,20K,$4x10^{18}$ e^-/cm^2 electron irradiation. Before irradiation the lifetime of positron in CdTe or CdTe(In doped) was 294ps and 297ps respectively. After irradiation, it was 320ps and 328ps respectively attesting the presence of irradiation induced defects able to trap positrons. An isochronal annealing is made in the range 20-80K and a recovery step is observed at 50K and explained in terms of close pair rearrangement or recombination.

53291 (CONF-901125–2) **Stress-displacement relation during fiber pullout.** Hsueh, C.H. Oak Ridge National Lab., TN (USA). [1990]. 7p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From 2. international ceramic science and technology congress symposium on glasses for electronic applications; Orlando, FL (USA); 12-15 Nov 1990. Order Number DE91000392. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

During fiber pullout tests of fiber-reinforced composites, initial debonding, partial debonding, complete debonding at the interface, and fiber pullout occur sequentially. Adopting the shear lag model for stress analyses and the strength criterion for interfacial debonding, a bond length dependence of the initial debond stress is derived. During partial debonding, the stress initially increases with the increasing fiber displacement. The partial debond stress reaches a maximum value and begins to decrease with an accompanying decreasing fiber displacement until the interface is completely debonded. Theoretically, the stress-displacement curve shows a "nose" at the maximum debond stress. However, the pullout test is generally conducted under the condition of an increasing fiber displacement. Hence, at the maximum debond stress, the observed stress drops abruptly as the increasing fiber displacement type test obscures the nose-type characteristic.

53292 (CONF-9006174–2) **Patterning and overgrowth of nanostructure quantum well wire arrays by LP-MOVPE [low pressure Metalorganic Vapor Phase Epitaxy].** Karam, N.H. (Spire Corp., Bedford, MA (USA)); Mastrovito, A.; Haven, V.; Ismail, K.; Pennycook, S.; Smith, H.I. Oak Ridge National Lab., TN (USA). Jun 1990. 15p. Sponsored by U.S. Department of Defense; U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From 5. international conference on metalorganic vapor phase epitaxy; Aachen (Germany, F.R.); 18-21 Jun 1990. Order Number DE91000717. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Nanometer scale GaAs Quantum Well Wire (QWW) arrays with lateral dimensions in the range of 10–70 nm and a period of 200 nm have been fabricated in the GaAs/AlGaAs system using x-ray nanolithography patterning and overgrowth by a low pressure Metalorganic Vapor Phase Epitaxy (LP-MOVPE) technique. The QWW structures were either fabricated by post-growth patterning of a thin GaAs film on a AlGaAs-coated substrate followed by AlGaAs deposition, or by continuous in-situ deposition of a GaAs/AlGaAs QWW structure on a prepatterned GaAs substrate. Although cross-sectional transmission electron microscopy showed no structural defects in either QWW fabrication process, photoluminescence (PL) was only observed in the in-situ-deposited structures. Strong polarization dependence of the PL peak with respect to wire orientation has been confirmed and evidence of lateral confinement was observed. 17 refs., 4 figs.

53293 (DOE/ER/45276–4) **The coupling of thermochemistry and phase diagrams for group 3-5 semiconductor systems: Progress report, September 1, 1989–April 30, 1990.** Anderson, T.J. Florida Univ., Gainesville, FL (USA). Dept. of Chemical Engineering. 1990. 17p. Sponsored by U.S. DOE Energy Research. DOE Contract FG05-86ER45276. Order Number DE91000934. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Progress in the first year of the renewal and fourth year of the program has primarily occurred in the experimental area and subsequent assessment of binary and ternary systems. Thermodynamic studies of the Al–In and Al–Sb systems have been carried out using solid electrolyte galvanic cells. Using the sensitive coulometric titration technique, aluminum activities were obtained for both systems. In addition, liquidus data were obtained for the Al–Sb system, and the Gibbs energy of formation of AlSb was determined. A detailed description of the work for the Al–In system is given in Appendix I while that for the Al–Sb system in Appendix II. For the Al–Sb system, the coulometric titration technique was also used to investigate, for the first time, the very narrow region of homogeneity in the Al–Sb compound. The experimental data obtained in this study were used along with the available literature data in the critical assessment and calculation of the Al–In and Al–Sb systems.

53294 (DOE/ER/45391–1) **Theory of the electronic and structural properties of solid state oxides: Annual technical progress report, July 1, 1989–May 1, 1990.** Chelikowsky, J.R. Minnesota Univ., Minneapolis, MN (USA). Dept. of Chemical Engineering and Materials Science. 1990. 75p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-89ER45391. Order Number DE91001192. Source: NTIS, PC A04/MF A01 - OSTI; GPO Dep.

Studies on electronic and structural properties of solid state oxides continued. This quarter, studies have concentrated on silica. Progress is discussed in the following sections: interatomic potentials and the structural properties of silica; chemical reactivity and covalent/metallic bonding on Si clusters; and surface and thermodynamic interatomic forces fields for silicon. 64 refs., 20 figs., 5 tabs. (CBS)

53295 (DOE/NASA/20320–76) **Structural properties of laminated Douglas fir/epoxy composite material.** Spera, D.A. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center); Esgar, J.B.; Gougeon, M.; Zuteck, M.D. National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center. May 1990. 127p. Sponsored by U.S. DOE Conservation & Renewable Energy; National Aeronautics and Space Administration. DOE Contract AI01-76ET20320. (NASA-RP–1236). Order Number DE91000529. Source: NTIS, PC A07/MF A01 - OSTI; GPO Dep.

This publication contains a compilation of static and fatigue and strength data for laminated-wood material made from Douglas fir and epoxy. Results of tests conducted by several organizations are correlated to provide insight into the effects of variables such as moisture, size, lamina-to-lamina joint design, wood veneer grade, and the ratio of cyclic stress to steady stress during fatigue testing. These test data were originally obtained during development of wood rotor blades for large-scale wind turbines of the horizontal-axis (propeller) configuration. Most of the strength property data in this compilation are not found in the published literature. Test sections ranged from round cylinders 2.25 in. in diameter to rectangular slabs 6 in. by 24 in. in cross section and approximately 30 ft long. All specimens were made from Douglas fir veneers 0.10 in. thick, bonded together with the WEST epoxy system developed for fabrication and repair of wood boats. Loading was usually parallel to the grain. Size effects (reduction in strength with increase in test volume) are observed in some of the test data, and a simple mathematical model is presented that includes the probability of failure. General characteristics of the wood/epoxy laminate are discussed, including features that make it useful for a wide variety of applications. 9 refs.

53296 (IAEA-TECDOC–551, pp. 67-74) **Radiation degradation of insulating materials under stress.** Yagi, T. (Japan Atomic Energy Research Inst., Takasaki, Gunma (Japan). Takasaki Radiation Chemistry Research Establishment); Kusama, Y.; Itoh, M.; Kawakami, W. International Atomic Energy Agency, Vienna (Austria). Apr 1990. (CONF-8907223–: Final research co-ordination meeting on radiation damage to organic materials in nuclear reactors and radiation environments, Takasaki (Japan), 17-20 Jul 1989). In *Radiation damage to organic materials in nuclear reactors and radiation environments: Proceedings of a final research co-ordination meeting, held in Takasaki, Japan, 17-20 July 1989.* 163p. Order Number DE91605608. Source: NTIS (US Sales Only), PC A08/MF A01; OSTI; INIS.

Effects of stress on the radiation degradation of insulating and jacketing materials of electric wires were studied. Dumbbell-shaped samples of four kinds of insulating and jacketing materials such as chlorosulfonated polyethylene (CSM), ethylene-propylene rubber (EPR), chloroprene (CR) and silicone rubber (SiR) were exposed to various conditions of irradiation under stress. The irradiation was carried out at room temperature and at dose rates ranging from 1 to 10kGy/h in air, and at 4.5 kGy/h under oxygen pressure of 0.5 MPa up to dose of 2.0 MGy. Stress were added by straining the samples from 0 to 100% of the initial length. Tensile properties were measured by using Shimazu Autograph (type DCS-500) with a cross head speed of 200 mm/min, and the breaking energy was calculated from the stress-strain curves. The tension set (permanent strain) was not seen without irradiation, but observed to increase with the dose and initial strain for all materials and not to depend on irradiation conditions. Those of EPR and SiR become equal to the initial strain above 1.0 MGy. These tension sets are not annealed by heating at 100-120 deg. C for 24 hours. The elongation and strength at break decrease with the dose and initial strain. And the influence of the initial strain on the degradation is seen more clearly in the elongation for CSM and CR, and in the tensile strength for EPR and SiR, respectively. The influence of the initial strain was also examined by the value $D_{50\%}$ which is defined as a dose at which the breaking energy calculated from the stress-strain curve becomes to 50% of the unirradiated sample's value. It is shown that $D_{50\%}$ decreases with the initial strain linearly and that the irradiation at a low dose rate or in oxygen over pressure gives lower values for CSM, and that $D_{50\%}$ for EPR does not depend on the initial strain and irradiation conditions. (author). 3 refs, 8 figs.

53297 (IAEA-TECDOC–551, pp. 75-88) **Qualification methods for PWR power plant safety equipment.** Carlin, F. (Compagnie ORIS Industrie, 91 - Gif-sur-Yvette (France)); Chenion, J.; Attal, M.; Gaussens, G. International Atomic Energy Agency, Vienna (Austria). Apr 1990. (CONF-8907223–: Final research co-ordination meeting on radiation damage to organic materials in nuclear reactors and radiation environments, Takasaki (Japan), 17-20 Jul 1989). In *Radiation damage to organic materials in nuclear reactors and radiation environments: Proceedings of a final research co-ordination meeting, held in Takasaki, Japan, 17-20 July 1989.* 163p. Order Number DE91605608. Source: NTIS (US Sales Only), PC A08/MF A01; OSTI; INIS.

The effect of the natural and accidental environment of PWR containment has been studied on industrial polymeric materials in three cases. (a) Effect of alterning aging and accident simulation conditions on the properties of polymers: 23 polymeric materials were studied the first time at the thermal and irradiation aging and the second time at sequential (steam after or before γ radiation) and simultaneous (steam during γ radiation) accidental environment. The new facility CESAR was built for carrying out the steam profiles. For these 23 polymeric materials results are in good agreement with the actual qualification sequences of equipment which is actually simulated by sequential aging tests followed by sequential accident tests (radiation before steam). (b) Comparison of the effects of irradiation on the mechanical properties of polymer materials: This study was carried out for several energies of electron and four thickness of EPR slabs. Using mechanical properties a same aging effect between β and γ radiation for an equivalent absorbed dose and for a sufficiently thin slab for the electron beam energy was shown. The effect of the thickness of the sheet was shown for the β irradiation. (c) Effect of irradiation at very low dose rates on polymer material behaviour: Three materials have been irradiated since five years with cobalt 60 rays at three dose-rates lower than 5,6 10^{-4} Gry.s^{-1} (200 rads.h^{-1}). The temperature was maintained at 80 deg. C during irradiation. The G value of oxygen consumption and the mechanical properties was measured. A very large G (-0_2) was found at the beginning of the irradiation. The G (-0_2) decreases when the dose rate increases and when the absorbed dose increases. (author). 9 refs, 8 figs.

53298 (IAEA-TECDOC–551, pp. 89-106) **Radiation aging of polymers.** Burnay, S.G. (UKAEA Harwell Lab. (UK)); Rudd, H.J.; Johnson, D.I. International Atomic Energy Agency, Vienna (Austria). Apr 1990. (CONF-8907223–: Final research co-ordination meeting on radiation damage to organic materials in nuclear reactors and radiation environments, Takasaki (Japan), 17-20 Jul 1989). In *Radiation damage to organic materials in nuclear reactors and radiation environments: Proceedings of a final research co-ordination meeting, held in Takasaki, Japan, 17-20 July 1989.* 163p. Order Number DE91605608. Source: NTIS (US Sales Only), PC A08/MF A01; OSTI; INIS.

Dose rate effects in both commercial polymeric components and in a model system have been studied. In the commercial systems, materials based on the same generic polymer type can show no dose rate effect, a positive effect (low dose rate being worse than high dose rate) or a negative effect (low dose rate being better than high dose rate). Data are presented for changes in tensile properties after irradiation at 0.014 and 0.67 Gy/s for doses up to 6.6 x 10^6 Gy. In a model ethylene-propylene system studied, changes in mechanical properties, swelling behaviour, IR spectra, and dynamic mechanical analysis have been measured. The samples were irradiated in vacuum and in pure oxygen to 10^5 Gy at dose rates from 0.008 to 0.208 Gy/s; sample thickness was low enough to ensure homogeneous oxidation through the thickness of the sample. In this material no significant dose rate effects have been positively identified at the total dose used. (author). 10 refs, 13 figs, 7 tabs.

53299 (IAEA-TECDOC–551, pp. 107-118) **Compilation of radiation damage test data.** Schoenbacher, H. (European Organization for Nuclear Research, Geneva (Switzerland)); Tartaglia, R.; Tavlet, M. International Atomic Energy Agency, Vienna (Austria). Apr 1990. (CONF-8907223–: Final research co-ordination meeting on radiation damage to organic materials in nuclear reactors and radiation environments, Takasaki (Japan), 17-20 Jul 1989). In *Radiation damage to organic materials in nuclear reactors and radiation environments: Proceedings of a final research co-ordination meeting, held in Takasaki, Japan, 17-20 July 1989.* 163p. Order Number DE91605608. Source: NTIS (US Sales Only), PC A08/MF A01; OSTI; INIS.

The paper gives a short description and lists the main entries of the CERN radiation damage test data compilations which are published or in preparation. Available are at present three parts: Part I contains commercial cable insulating materials, Part II contains thermoplastic and thermosetting resins with exception of cable materials and Part III a variety of items which are used in high energy particle accelerator engineering such as cable ties, hoses, motors, oils, paints, scintillators, seals, etc. A second edition of Part I is in preparation which will contain over 300 halogen-free cable insulating materials irradiated at different dose rates. (author). 4 refs, 4 figs.

53300 (IAEA-TECDOC–551, pp. 119-132) **Experience with IEC standard 544 to assess radiation damage of organic insulating materials.** Schoenbacher, H. (European Organization for Nuclear Research, Geneva (Switzerland)); Tavlet, M. International Atomic Energy Agency, Vienna (Austria). Apr 1990. (CONF-8907223–: Final research co-ordination meeting on radiation damage to organic materials in nuclear reactors and radiation environments, Takasaki (Japan), 17-20 Jul 1989). In *Radiation damage to organic materials in nuclear reactors and radiation environments: Proceedings of a final research co-ordination meeting, held in Takasaki, Japan, 17-20 July 1989.* 163p. Order Number DE91605608. Source: NTIS (US Sales Only), PC A08/MF A01; OSTI; INIS.

The essential topics of IEC Standard 544 are presented which contains four parts: I Radiation interaction, II Procedures for irradiation, III Test procedures for permanent effects and IV Classification system for Service in radiation environments. The topics described include test procedures, critical parameters and endpoint criteria, dose rate and the Radiation Index. Experience at CERN is reported which is based on radiation testing of many hundreds of organic insulating materials supplied by a large number of different manufacturers. The experience with rigid plastics, eg. epoxy resins, were extremely positive, whereas with flexible plastics, mainly cable insulation and sheath materials, several difficulties did occur. It was however found that the recommended procedure to assess the dose rate effect clearly allows to identify materials where this effect is of importance and that the Radiation Index is a simple and clearly defined tool to rank materials according to their radiation resistance. (author). 6 refs, 4 figs, 4 tabs.

53301 (IAEA-TECDOC–551, pp. 149-161) **Radiation and thermal degradation on polymer materials.** Baccaro, S. (ENEA, Casaccia (Italy). Centro Ricerche Energia); D'Atanasio, P.; Anelli, P.; Lombardi, A. International Atomic Energy Agency, Vienna (Austria). Apr 1990. (CONF-8907223–: Final research co-ordination meeting on radiation damage to organic materials in nuclear reactors and radiation environments, Takasaki (Japan), 17-20 Jul 1989). In *Radiation damage to organic materials in nuclear reactors and radiation environments: Proceedings of a final research co-ordination meeting, held in Takasaki, Japan, 17-20 July 1989.* 163p. Order Number DE91605608. Source: NTIS (US Sales Only), PC A08/MF A01; OSTI; INIS.

In this work we have studied the degradation and damaging effects induced by radiation and by temperature on AFUMEX^R, an insulation for electrical cables produced and marketed by Pirelli Cable Society and on a cable coming from a decommissioned Italian nuclear plant. As it regards AFUMEX^R we obtained the following results. Three thermal aging curves were obtained and an activation energy of 1.23 eV was found. Radiation damage was evaluated by measuring the decrease in the elastic properties and was found greater when thermal ageing followed radiation. Mainly hydrogen and carbon dioxide were evolved by the samples subjected to radiation and their quantity increased with the absorbed dose. Radiation seemed to produce no effect on the oxygen index values. Thermogravimetric tests for samples either thermally aged and then irradiated or just irradiated showed that significant oxidation phenomena were produced. The ESR technique has been used to investigate the behaviour of irradiation induced free-radicals in different environmental conditions; the signal was unaffected till a dose value of 10 KGy beyond which increased as a function of the absorbed dose. The signal increased 47% for samples irradiated in vacuum and 59% for those in air: time dependance of the signal showed a marked fading for the former and an increase for the latter. This suggests the presence of oxidative degradation processes in the material. Two different materials based on EPR 30% and 50% propylene respectively did not exhibit any difference as for their radiation resistance either in air or in argon. As it concerns the cables coming from a decommissioned Italian nuclear plant we have not found significant differences in tensile properties between cables stocked in the storehouse and those which had been in

use. Insulation constant and partial discharges indicated a slight ageing of the latter. (author). 9 refs, 12 figs, 2 tabs.

53302 (INPE–4685) **Fabrication and characterization of semiconductor lasers (Pb_{1-x} Sn_x Te) using the epitaxy technique departing from the liquid phase.** Abramof, E. Instituto de Pesquisas Espaciais (INPE), Sao Jose dos Campos, SP (Brazil). Aug 1988. 109p. (In Portuguese). (TDL–341). Order Number DE91605678. Source: NTIS (US Sales Only), PC A06/MF A01; OSTI; INIS.

All the steps in the laser fabrication are described since the single crystal growth until the characterization of the device. (A.C.A.S.).

53303 (IS-T–1409) **Synchrotron radiation photoemission study of metal overlayers on hydrogenated amorphous silicon at room temperature.** Pi, J. Ames Lab., IA (USA). 21 Sep 1990. 113p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-82. Order Number DE91000740. Source: NTIS, PC A06/MF A01 - OSTI; GPO Dep.

In this dissertation, metals deposited on a hydrogenated amorphous silicon (a-Si:H) film at room temperature are studied. The purpose of this work is mainly understanding the electronic properties of the interface, using high-resolution synchrotron radiation photoemission techniques as a probe. Atomic hydrogen plays an important role in passivating dangling bonds of a-Si:H films, thus reducing the gap-state distribution. In addition, singly bonded hydrogen also reduces states at the top of the valence band which are now replaced by deeper Si-H bonding states. The interface is formed by evaporating metal on an a-Si:H film in successive accumulations at room temperature. Au, Ag, and Cr were chosen as the deposited metals. Undoped films were used as substrates. Since some unique features can be found in a-Si:H, such as surface enrichment of hydrogen diffused from the bulk and instability of the free surface, we do not expect the metals/a-Si:H interface to behave exactly as its crystalline counterpart. Metal deposits, at low coverages, are found to gather preferentially around regions deficient in hydrogen. As the thickness is increased, some Si atoms in those regions are likely to leave their sites to intermix with metal overlayers like Au and Cr. 129 refs., 30 figs.

53304 (IS-T–1518) **An analysis of commerical zeolite catalysts by multinuclear NMR.** Flanagan, L. Ames Lab., IA (USA). 21 Sep 1990. 67p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-82. Order Number DE91000666. Source: NTIS, PC A04/MF A01 - OSTI; GPO Dep.

This work involves studying two commercial hydrocracking catalysts by solid state multinuclear NMR silicon 29 and aluminum 27 with the goal of developing a method of determining the fraction zeolite in the catalysts. The zeolite fraction is known to be one of the faujasite zeolites type X or Y. The clay matrix of the catalyst is assumed to be kaolinite. Fresh, air-exposed commercial hydrocracking catalysts were provided by Phillips Petroleum. Sample 33351-86 was known to be a physical mixture of a Y zeolite and a clay matrix. The other catalyst, 33351-20, was composed of a faujasite zeolite grown within a clay matrix. Both were suspected of being about 20 wt % zeolite. Nothing is known about the state of pretreatment or cation exchange. A portion of each catalyst was calcined in a porcelain crucible in air at 500°C for two hours with a hour heating ramp preceding and a two hour cooling ramp following calcination. 64 refs., 21 figs., 8 tabs.

53305 (Juel–2332) **Investigations at radiation-induced long-living states in $[Fe(CN)_5NO]^{2-}$ by differential scanning calorimetry and absorption spectroscopy.** Zoellner, H. Kernforschungsanlage Juelich GmbH (Germany, F.R.). Inst. fuer Festkoerperforschung; Koeln Univ. (Germany, F.R.). Dec 1989. 91p. (In German). Order Number DE91717317. Source: NTIS (US Sales Only), PC A05/MF A01.

A photochromatic effect could be proved in several samples which contain the $[Fe(CN)_5NO]^{2-}$ complex. The reaction kinetics of the thermal decay of two similar, but separable states were analysed and investigated by absorption in the visible and near infrared spectral range. (BHO).

53306 (Juel–2358) **The investigation of the crystal field splitting of REP_5 by magnetic inelastic neutron diffraction and the collection of the crystal field operators.** Hoffmann, P. Forschungszentrum Juelich GmbH (Germany, F.R.). Inst. fuer Festkoerperforschung. May 1990. 155p. (In German). Order Number DE91717318. Source: NTIS (US Sales Only), PC A08/MF A01.

By means of inelastic magnetic neutron scattering the rare earth pentaphosphides REP_5 (RE=Ce, Pr, Nd, Dy) were investigated to determine the monoclinic crystal field splitting of the lowest J multiplet. It was shown that the two tetragonal crystal field parameters A_{20}=-105.8 meV/A^2 and A_{40}=5.1 meV/A^4 yields a first good approximation to explain the splittings and susceptibility measurements (except for NdP_5 which shows superstructure). Besides that the author pointed out how Stevens' operator equivalent method can be generalized to collect all of the tabulated tensoroperators and crystal field operators in some few formulas. (orig.).

53307 (KCP–613-4253) **Physical properties of contaminated trichloroethylene and 1,1,1- trichloroethane.** Holt, R.D. Allied-Signal Aerospace Co., Kansas City, MO (USA). Kansas City Div. Oct 1990. 87p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00613. Order Number DE91001036. Source: NTIS, PC A05/MF A01 - OSTI; GPO Dep.

The specific gravity, volume change, dielectric constant, dissipation factor, boiling point, and nonvolatile residue carryover during distillation was measured for various contamination levels of rosin in trichloroethylene and 1,1,1-trichloroethane. Solvent stabilizers and the vapor pressure of solvents were examined. The effects of unknown contamination in solvents from manufacturing departments were measured. The theoretical effects of oil contamination on the boiling point are discussed. 18 refs., 15 figs., 13 tabs.

53308 (KURRI-TR–330, pp. 102-106) **Electron irradiation effects on high-temperature oxide superconductors.** Shiraishi, Kensuke (Japan Atomic Energy Research Inst., Takasaki, Gunma (Japan). Takasaki Radiation Chemistry Research Establishment). Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst. Mar 1990. (In Japanese). (CONF-8908245–: Workshop on development and application of low temperature irradiation and irradiation facilities; Workshop on development and application of low temperature irradiation and irradiation facilities, Kumatori (Japan); KUMATORI (is not a va In *Proceedings of the workshop on development and application of low temperature irradiation and irradiation facilities.* 145p. Order Number DE90513870. Source: NTIS (US Sales Only), PC A07/MF A01.

Published in summary form only. BARIUM OXIDES/ superconductivity; SUPERCONDUCTIVITY/radiation effects; SUPERCONDUCTIVITY; YTTRIUM OXIDES; COPPER OXIDES; IRRADIATION; ELECTRONS; CRITICAL CURRENT; BISMUTH OXIDES; LEAD OXIDES; STRONTIUM OXIDES; CALCIUM OXIDES; CERAMICS; MAGNETIZATION; CURRENT DENSITY

53309 (KURRI-TR–330, pp. 107-110) **Irradiation/strain effects in A15 superconducting wires.** Katagiri, K. (Osaka Univ., Ibaraki (Japan). Inst. of Scientific and Industrial Research); Okada, T. Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst. Mar 1990. (In Japanese). (CONF-8908245–: Workshop on development and application of low temperature irradiation and irradiation facilities; Workshop on development and application of low temperature irradiation and irradiation facilities, Kumatori (Japan); KUMATORI (is not a va In *Proceedings of the workshop on development and application of low temperature irradiation and irradiation facilities.* 145p. Order Number DE90513870. Source: NTIS (US Sales Only), PC A07/MF A01.

Published in summary form only. SUPERCONDUCTING WIRES/ physical radiation effects; NIOBIUM ALLOYS/superconducting wires; TIN ALLOYS; COPPER ALLOYS; TITANIUM ADDITIONS; ZIRCONIUM ALLOYS; IRRADIATION; THERMAL NEUTRONS; CRITICAL CURRENT; MAGNETOSTRICTION; THERMONUCLEAR REACTOR MATERIALS; INTERMETALLIC COMPOUNDS; CHEMICAL COMPOSITION

53310 (KURRI-TR–330, pp. 111-113) **Composite-diffusion processed Nb_3Al superconducting wires for fusion reactor magnet use.** Kuroda, T. (National Research Inst. for Metals, Tokyo (Japan)); Takeuchi, T.; Wada, H. Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst. Mar 1990. (In Japanese). (CONF-8908245–: Workshop on development and application of low

temperature irradiation and irradiation facilities; Workshop on development and application of low temperature irradiation and irradiation facilities, Kumatori (Japan); KUMATORI (is not a va In *Proceedings of the workshop on development and application of low temperature irradiation and irradiation facilities.* 145p. Order Number DE90513870. Source: NTIS (US Sales Only), PC A07/MF A01.

Published in summary form only. SUPERCONDUCTING WIRES/ niobium alloys; NIOBIUM ALLOYS/superconducting wires; SAMPLE PREPARATION; ALUMINIUM ALLOYS; MAGNESIUM ALLOYS; COPPER ALLOYS; GERMANIUM ALLOYS; SILVER ALLOYS; CRITICAL CURRENT; SUPERCONDUCTIVITY; STRESSES; THERMONUCLEAR REACTOR MATERIALS; INTERMETALLIC COMPOUNDS; COMPOSITE MATERIALS

53311 (KURRI-TR–330, pp. 114-116) **Irradiation effect on organic composite materials.** Nishijima, S. (Osaka Univ., Ibaraki (Japan). Inst. of Scientific and Industrial Research); Okada, T. Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst. Mar 1990. (In Japanese). (CONF-8908245–: Workshop on development and application of low temperature irradiation and irradiation facilities; Workshop on development and application of low temperature irradiation and irradiation facilities, Kumatori (Japan); KUMATORI (is not a va In *Proceedings of the workshop on development and application of low temperature irradiation and irradiation facilities.* 145p. Order Number DE90513870. Source: NTIS (US Sales Only), PC A07/MF A01.

Published in summary form only. COMPOSITE MATERIALS/ physical radiation effects; TEXTILES; ORGANIC INSULATORS; FIBERS; TENSILE PROPERTIES; SHEAR PROPERTIES; RUPTURES; IRRADIATION; THERMAL NEUTRONS; THERMONUCLEAR REACTOR MATERIALS

53312 (LA-UR–90-3317) **A step back: Hydrogen abstraction from methane using a semiempirical molecular orbital method.** Valone, S.M. Los Alamos National Lab., NM (USA). [1990]. 8p. Sponsored by U.S. DOE Office of Administration and Human Resource Management. DOE Contract W-7405-ENG-36. (CONF-900731–3: NATO Advanced Study Institute on diamond and diamond-like films and coatings, Castelvecchio Pascoli (Italy), 22 Jul - 2 aug 1990). Order Number DE91000186. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Several studies have new been completed using semiempirical molecular orbital methods to learn about various aspects of diamond growth. Whole reaction mechanisms for diamond epitaxy have been proposed on the basis of these calculations with supporting evidence from experiment. Attempts have been made to understand the roles of hydrogen atoms, methyl groups, acetylene groups and charged species in diamond film growth from both hot filament and plasmas sources. For the semiempirical method to provide a reasonable description of a diamond film, it is essential that molecular species and configurations to be encountered in the system be included in the parameterization of the method. One way to verify appropriateness of the method is by testing it against simple systems for which detailed experimental measurements and ab initio calculations are available. Unfortunately, the semiempirical methods used in earlier studies have never been tested against simple known systems closely resembling the ones of interest to diamond films. Here we propose to make just such a test, the simplest being the abstraction of hydrogen from methane by a hydrogen atom. Not only is the system simple, but also both experimental and highly accurate theoretical results known for the transition state energy and geometry, key parameters for comparison. The results are reported after a brief review of the computational methods. 10 refs., 3 figs.

53313 (MLM-MU–90-69-0003) **Kapton HN investigations.** Williams, M.K. (EG and G Mound Applied Technologies, Miamisburg, OH (USA)); Huelskamp, M.A.; Armstrong, K.P.; Brandon, J.L.; Lavois, J.M.; Smith, A.E. EG and G Mound Applied Technologies, Miamisburg, OH (USA). 28 Sep 1990. 18p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-88DP43495. Order Number DE91001320. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Kapton HN properties and the properties of the slip additive calcium phosphate dibasic ($CaHPO_4$) were investigated. Impurity analyses were performed on the compound by inductively coupled plasma (ICP) and ion chromatography (IC). Other analyses on the slip additive included: processing solution – dissolution analysis, high-explosive compatibility studies, scanning electron microscopy/ energy dispersive spectroscopy (SEM/EDS), and particle size distribution. Testing and analyses were also performed on Kapton HN film and other polyimide films that could serve as possible replacements for Kapton HN. The polyimide films that were tested are: Upilex-R, Upilex-S, Upilex-SGA, and Apical. The analyses performed were: infrared (IR), x-ray photoelectron spectroscopy (XPS), SEM/EDS, high-potential breakdown testing, (PVD) physical vapor deposition adhesion tests, and peel tests. Upilex-S flyer cables were also fabricated and successfully test fired. In addition to these raw material tests, production cables were chemically treated and destructively (high potential) tested. A long-term aging environment for production cables was also selected, and aging tests were begun. 9 figs., 7 tabs.

53314 (ORNL–6603) **Updated evaluation of polymer films for electrical insulation.** McCoy, H.E. Jr. Oak Ridge National Lab., TN (USA). Aug 1990. 66p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC05-84OR21400. Order Number DE91000544. Source: NTIS, PC A04/MF A01 - OSTI; GPO Dep.

Several types of tests have been run on polymer film materials that could be useful for electrical insulation. The polymers studied were polyethylene terephtalate, polycarbonate, polysulfone, polyetherimide, ultrahigh-molecular-weight polyethylene, polyimide, polybutylene terephthalate, and a laminate of Kraft paper and polypropylene. Thermal aging tests were run to 60,000 h on several of the polymers, and the samples were evaluated by tensile tests, electrical breakdown tests, and immersion density measurements. Because of the wide range of potential service conditions, tensile tests were run on as-received materials over the temperature range of −196 to 200°C. Polyimide is probably the only material suitable for the extremes of this temperature range, but many of the other polymers would be suitable for intermediate temperatures. Creep tests were run in nitrogen and transformer oil at 90°C. It was found that some polymers are weaker and less ductile in oil than in nitrogen and that other polymers have equivalent properties in the two environments. A means of applying mechanical, thermal, and electrical stresses simultaneously to polymer samples was developed. Tests were run at 90°C in transformer oil on polyethylene terephthalate, polyimide, and polyethersulfone. Tests thus far do not indicate that the creep rate is affected by the application of a 5 kV dc potential. 7 refs., 30 figs., 16 tabs.

53315 (SAND–90-1125C) **Photoluminescence and structural characterization of MeV erbium implanted silica glass.** Polman, A. (AT and T Bell Labs., Murray Hill, NJ (USA)); Jacobson, D.C.; Lidgard, A.; Poate, J.M.; Arnold, G.W. Sandia National Labs., Albuquerque, NM (USA). [1990]. 7p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-900936–13: 7. international conference on ion beam modification of materials, Knoxville, TN (USA), 9-14 Sep 1990). Order Number DE91001225. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Suprasil glass (amorphous SiO_2) has been implanted with 2.9 MeV Er ions at fluences of 3.4×10^{15} and 3.4×10^{16} ions/cm^2. Photoluminescence spectra of implanted samples show a clear luminescent transition around $\lambda = 1.54$ μm, corresponding to an intra-4f transition of Er^{3+}. Fluorescence decay times are in the range 1–8 ms., depending on implantation fluence and annealing treatment. UV absorption and IR reflection spectroscopy are employed to characterize beam-induced defects in the silica network. The results indicate that defects in the silica network play an important role in the energy transfer processes in the Er:silica system. 15 refs., 3 figs.

53316 (SAND–90-1675C) **Sintering maps for ceramic-filled-glass composites.** Ewsuk, K.G. Sandia National Labs., Albuquerque, NM (USA). [1990]. 12p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-901125–3: 2. international ceramic science and technology congress symposium on glasses for electronic applications, Orlando, FL (USA), 12-15 Nov 1990). Order Number DE91001229. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Ceramic-filled-glass (CFG) composites densify by viscous flow during final-stage, non-reactive, liquid-phase sintering (NLPS). The rate of densification is controlled by the viscosity of the CFG composite dispersion during sintering, which is determined by the concentration of ceramic filler in the composite, and the viscosity of the suspending glass medium. A mathematical expression has been developed that determines the critical filler concentration in a given viscosity glass at which high-density CFG composites will be produced in a given time during final-stage NLPS. This expression has been used to predict the effects of sintering time, pore size, and glass viscosity on critical filler concentration, and to construct final-stage sintering maps that provide guidelines for designing and processing high-density CFG composites. 12 refs., 2 figs.

53317 (SAND–90-1911C) **Band-gap narrowing and III-V heterostructure FETs [Field-Effect Transistors].** Myers, D.R. (Sandia National Labs., Albuquerque, NM (USA)); Lott, J.A.; Klem, J.F.; Tigges, C.P.; Lowney, J.R. Sandia National Labs., Albuquerque, NM (USA). [1990]. 5p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-901244–1: 1990 international electron device conference, San Francisco, CA (USA), 10-12 Dec 1990). Order Number DE91000401. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

We calculate the magnitude of band-gap narrowing for GaAs-based alloys, and have included these results into one-dimensional heterojunction device models for strained $In_{0.15}Ga_{0.85}As$ quantum-well MODulation-doped Field-Effect Transistors (MODFETs). Equivalent rigid shifts of as much as 1.2 meV are obtained for the valence band of depleted p-type $Al_{0.15}Ga_{0.85}As$ doped at $5 \times 10^{18}/cm^3$. Our simulations suggest that band-gap narrowing is most significant for p-channel MODFETs. The predicted effect of band-gap narrowing in p-channel MODFETs is the formation of parasitic conduction in the low-mobility parent dopant region. The parasitic conduction would reduce the intrinsic gain. 13 refs., 4 figs.

53318 (SAND–90-2355C) **Formation of catalysts in inverse micelles.** Wilcoxon, J.P.; Baughmann, R.J.; Williamson, R.L. Sandia National Labs., Albuquerque, NM (USA). [1990]. 5p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-901105–17: Fall meeting of the Materials Research Society, Boston, MA (USA), 24 Nov - 1 dec 1990). Order Number DE91001337. Source: NTIS, PC A01/MF A01 - OSTI; GPO Dep.

We report formation of several small colloidal metal catatlysts in inverted micelle (oil-continuous) systems. These materials have demonstrated catalytic activity in situ (i.e. unsupported). The range of solvents possible in this process is large, including all saturated hydrocarbons, cyclic hydrocarbons (e.g. cyclohexane) and aromatics (e.g. toluene, xylene). Three classes of micelle system were investigated, nonionic, anionic, and cationic. Nonionic types allow precise size control but in general do not act as strong stabilizing agents at high temperatures. Cationics can be chosen to provide this permanent stability, providing both charge and steric stabilization. Metal systems formed include Rh, Ni, NiB, MoO_2, Pd, Au and Ag and alloys. Selected examples are given. 4 figs.

53319 (UCRL-ID–103928) **Thermomechanical properties of Cr:Tm:Ho:$Y_3Al_5O_{12}$.** Marion, J.E. Lawrence Livermore National Lab., CA (USA). 15 May 1990. 9p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. Order Number DE91000501. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The thermomechanical properties of Cr:Ho:Tm:$Y_3Al_5O_{12}$ have been measured and compared to similar measurements on Nd:$Y_3Al_5O_{12}$. We find that, in general, the properties are similar, with the single exception being thermal diffusivity. Nd:YAG has substantially higher thermal diffusivity than Cr:Tm:Ho:YAG. Consequently, the intrinsic thermal stress resistance figure of merit which governs a materials resistance to fracture in the presence of a steady thermal gradient is lower in Cr:Tm:Ho:YAG than in Nd:YAG. 6 refs., 1 tab.

53320 **Determination of hydrogen (deuterium) density profiles in thin metal films and multilayers by neutron reflection.** Majkrzak, C.F. (National Institute of Standards and Technology, Gaithersburg, MD (US)); Satija, S.; Neumann, D.A.; Rush, J.J.; Lashmore, D.; Johnson, C.; Bradshaw, J.; Passell, L.; DiNardo, R. pp. 127-132 of Neutron scattering for materials science. Materials Research Society proceedings: Volume 166. Shapiro, S.M.; Moss, S.C.; Jorgensen, J.D. Materials Research Society, Pittsburgh, PA (USA) (1990). pp. 499 (CONF-891119–: Materials Research Society fall meeting, Boston, MA (USA), 27 Nov - 2 dec 1989).

The density of hydrogen in thin films of multilayers of metal hydrides can be inferred from an expansion of the host lattice as measured by conventional x-ray diffraction techniques. However because hydrogen and deuterium have scattering lengths for neutrons that are comparable to those of most metal nuclei, unlike the corresponding case for x-ray atomic scattering amplitudes, the hydrogen density profile normal to the surface of a flat, thin film can be determined directly from neutron reflectivity measurements. The hydrogen (deuterium) density modulation in an artificial superlattice along the growth direction can also be determined in this manner. The thin film or multilayer host metal material need not even be crystalline. Furthermore, because relatively large, flat single crystal substrates such as Si or quartz are nearly transparent to neutrons, the substrate can serve as the incident medium and the reflectivities of films or multilayers in contact with liquid solutions can be obtained. Thus, in situ studies employing active electrochemical cells, for example, can be performed. In addition to discussing the sensitivity of the method, the results of some neutron reflectivity experiments on metal multilayers and films, electrolytically loaded in situ with deuterium, are reported in this paper.

53321 **A neutron reflectivity study of the interfacial magnetism of an Y/Gd film.** Ankner, J.F. (Dept. of Physics and Materials Research Lab., Univ. of Illinois, Urbana, IL (US)); Zabel, H.; Matheny, A.; Dura, J.; Flynn, C.P.; Neumann, D.A. pp. 109-114 of Neutron scattering for materials science. Materials Research Society proceedings: Volume 166. Shapiro, S.M.; Moss, S.C.; Jorgensen, J.D. Materials Research Society, Pittsburgh, PA (USA) (1990). pp. 499 (CONF-891119–: Materials Research Society fall meeting, Boston, MA (USA), 27 Nov - 2 dec 1989).

Using the technique of polarized-neutron reflectometry, the authors have studied the magnetic moment distribution in the interfacial region of an epitaxial film consisting of 97 Å Y(0001) atop 1000Å Gd(0001). At T = 151 K, with an 80 gauss field applied parallel to the surface (basal plane), the authors observed two distinct ferromagnetic regions: the Gd bulk and a layer with reduced magnetic moment at the Y/Gd interface. Above the bulk Curie temperature, at T = 295 K (T_c^{Gd} = 293 K), the authors observe no net magnetization in either the bulk or the interface.

53322 **Interdiffusion of cadmium arachidate in Langmuir-Blodgett films.** Stroeve, P. (Dept. of Chemical Engineering, Univ. of California, Davis, CA (US)); Rabott, J.F.; Hilleke, R.O.; Felcher, G.P.; Chen, S.H. pp. 103-108 of Neutron scattering for materials science. Materials Research Society proceedings: Volume 166. Shapiro, S.M.; Moss, S.C.; Jorgensen, J.D. Materials Research Society, Pittsburgh, PA (USA) (1990). pp. 499 (CONF-891119–: Materials Research Society fall meeting, Boston, MA (USA), 27 Nov - 2 dec 1989).

The interdiffusion of cadmium arachidate (CdA) in Langmuir-Blodgett films has been studied by neutron reflection at the intense pulsed neutron source of Argonne National Laboratory. One of the samples consisted of a few layers of perhydro H-CdA deposited on a silicon support, overlayered with a few layers of deuterated D-CdA, for a total thickness of ~ 300 Angstroms. In a second sample the layers of perhydro- and deuterated- CdA were separated by two monolayers of H-n-octadecene/co-maleic acid copolymer. When heated for 15 minutes at 70°C, well below the disorder temperature, although the overall Langmuir-Blodgett film structure is known to remain unchanged. The presence of copolymer layers limited the interdiffusion process to about 5%.

53323 **Single point diamond turning of a organic nonlinear crystal, L-arginine phosphate.** Velsko, S.P.; Syn, C.; Fuchs, B.A. pp. 285-285 of Optical materials: Volume 152. Poker, D.B.; Ortiz, C. Materials Research Society, Pittsburgh, PA (USA) (1989). pp. 298 (CONF-8904283–: Optical materials: processing and science, San Diego, CA (USA), 24-26 Apr 1989).

The authors have demonstrated that single point diamond turning can be used to generated high optical quality finished surfaces on a new organic nonlinear crystal, L-arginine phosphate (LAP).

The proper choice of cutting conditions can produce surfaces with less than 5 angstroms rms surface roughness. Local softening or melting near the cutting tool tip may play a key role in the machining process by ensuring that material is removed by ductile cutting rather than brittle fracture. At the same time, the low melting temperature of LAP makes lubrication and cooling especially important to prevent extensive melting and tool fouling. In spite of the presence of a weak cleavage plane in LAP, the surface quality is relatively insensitive to crystallographic orientation. Tool wear is apparently negligible, so that surface flatness is governed by the stability of the diamond turning machine. Data on residual subsurface strain and preliminary measurements of the optical damage thresholds of diamond turned LAP surfaces are presented.

53324 **Structure and dynamics of glasses and liquids.** Price, D.L. (Argonne National Lab., Materials Science Division, Argonne, IL (US)). pp. 345-354 of Neutron scattering for materials science. Materials Research Society proceedings: Volume 166. Shapiro, S.M.; Moss, S.C.; Jorgensen, J.D. Materials Research Society, Pittsburgh, PA (USA) (1990). pp. 499 (CONF-891119–: Materials Research Society fall meeting, Boston, MA (USA), 27 Nov - 2 dec 1989).

Neutron scattering has proved to be a powerful tool in the study of glasses and liquids: structures are investigated by neutron diffraction, and dynamics by inelastic neutron scattering. Evidence of current interest in this field is provided by the new instruments for diffraction from amorphous systems.

53325 **Dynamics of weakly connected solids: Sintering of polymeric aerogels.** Schaefer, D.W. (Sandia National Lab., Albuquerque, NM (US)); Brinker, C.J.; Ashley, C.S.; Olivier, B.J.; Richter, D.; Farago, B.; Seeger, P. pp. 355-360 of Neutron scattering for materials science. Materials Research Society proceedings: Volume 166. Shapiro, S.M.; Moss, S.C.; Jorgensen, J.D. Materials Research Society, Pittsburgh, PA (USA) (1990). pp. 499 (CONF-891119–: Materials Research Society fall meeting, Boston, MA (USA), 27 Nov - 2 dec 1989).

A combination of small angle scattering (SAS) and neutron spin-echo (NSE) spectroscopy is sued to characterize the structure and dynamics of polymeric silica aerogels during length scales precedes the densification at longer scales (comparable to that of the pore structure). Interpreted within the fracton model, the NSE data are consistent with an initial decrease in connectivity during relatively early stages of densification.

53326 **Vibrational spectra for hydrogenated amorphous semiconductors.** Kamitakahara, W.A. (Ames Lab., Iowa State Univ., Ames, IA (US)); Bouchard, A.M.; Biswas, R.; Gompf, F.; Suck, J.B. pp. 361-366 of Neutron scattering for materials science. Materials Research Society proceedings: Volume 166. Shapiro, S.M.; Moss, S.C.; Jorgensen, J.D. Materials Research Society, Pittsburgh, PA (USA) (1990). pp. 499 (CONF-891119–: Materials Research Society fall meeting, Boston, MA (USA), 27 Nov - 2 dec 1989).

Hydrogen vibration spectra have been measured by neutron scattering for several amorphous semiconductor materials, including a-Ge:H and a-SiC:H samples containing about 10 at. % H. The data for a-Ge:H are compared in detail with the results of realistic computer simulations.

53327 **Comparison of neutron elastic and inelastic scattering from fused quartz, Cab-O-Sil and aerogel.** Root, J.H. (Atomic Energy of Canada, Ltd., Chalk River, Ontario (CA)); Buyers, W.J.L.; Page, J.H.; Schaeffer, D.W.; Brinker, C.J. pp. 379-384 of Neutron scattering for materials science. Materials Research Society proceedings: Volume 166. Shapiro, S.M.; Moss, S.C.; Jorgensen, J.D. Materials Research Society, Pittsburgh, PA (USA) (1990). pp. 499 (CONF-891119–: Materials Research Society fall meeting, Boston, MA (USA), 27 Nov - 2 dec 1989).

Neutron scattering experiments have been performed to study the structure and dynamics of three preparations of silica: a dense glass (fused quartz), a flame-hydrolyzed aggregate (Cab-O-Sil, grade M5) and a polymeric aerogel. The experiments were performed on the three materials at temperatures selected from 300, 77 and 4.2 K. Neutron inelastic scattering was measured at Q = 2.5, 2.9 and 4.0 $Å^{-1}$. The elastic scattering indicates a systematic decrease in positional correlations on progressing from fused quartz through Cab-O-Sil to aerogel.

53328 **Characterization of sol-clay composites by small-angle neutron scattering.** Moini, A. (Dept. of Chemistry and Center for Fundamental Materials Research, Michigan State Univ., East Lansing, MI (US)); Pinnavaia, T.J.; Thiyagarajan, P. pp. 391-396 of Neutron scattering for materials science. Materials Research Society proceedings: Volume 166. Shapiro, S.M.; Moss, S.C.; Jorgensen, J.D. Materials Research Society, Pittsburgh, PA (USA) (1990). pp. 499 (CONF-891119–: Materials Research Society fall meeting, Boston, MA (USA), 27 Nov - 2 dec 1989).

Silica-clay composites were prepared by reaction a 40 Å silica sol with aqueous clay suspensions. The clays which were studied included Na^+-montmorillonite, fluorohectorite, and the synthetic clay Laponite. The aggregation mechanism of the sol particles and the degree of dispersion of the clay layers were monitored by small-angle neutron scattering. The data for powdered silica-montmorillonite products showed the presence of highly dispersed clay platelets and spherical sol particles. The results suggest that the interaction between these two components inhibits the sol aggregation process. Studies on the products prepared from other types of clays, however, show that this interaction is highly dependent on the morphology and charge density of the clay platelets.

53329 **Top measurements of pulsed neutrons for texture analysis of low symmetry materials.** Larson, A.C. (Manuel Lujan Jr. Neutron Scattering Center, Los Alamos Natinal Lab., Los Alamos, NM (US)); Vergamini, P.J.; Wenk, H.R. pp. 337-344 of Neutron scattering for materials science. Materials Research Society proceedings: Volume 166. Shapiro, S.M.; Moss, S.C.; Jorgensen, J.D. Materials Research Society, Pittsburgh, PA (USA) (1990). pp. 499 (CONF-891119–: Materials Research Society fall meeting, Boston, MA (USA), 27 Nov - 2 dec 1989).

The single crystal diffractometer at LANSCE, SCD, provides an ideal capability for the study of preferred orientation in geological samples by time-of flight (TOF) measurement of pulsed neutrons. The 2-d position sensitive neutron detector with the large wave length range allows one to measure the complete distribution of intensities for several poles very quickly. Each histogram covers about $\pi_2/16$ radians of reciprocal space and contains information from all possible poles visible with the wave length range used, usually about 0.5 to 5.0 Å. With this method complete pole figures of many lattice planes can be constructed from only 12 to 20 sample orientations as compared to over 1000 sample settings per lattice plane using conventional diffractometers. Pole figures from measurements of experimentally deformed standard samples of calcite and quartzite with a known history of deformation provide information about deformation mechanisms and their temperature/strain history. This information can be applied to interpret preferred orientation of naturally deformed rocks.

53330 **Surface enrichment and evaporation in a polymer mixture of long and short chains.** Composto, R. (Polymer Research Institute, Univ. of Massachusetts, MA (US)); Stein, R.; Felcher, G.; Mansour, A.; Karim, A. pp. 485-490 of Neutron scattering for materials science. Shapiro, S.M.; Moss, S.C.; Jorgensen, J.D. Materials Research Society, Pittsburgh, PA (USA) (1990). pp. 499 (CONF-891119–: Materials Research Society fall meeting, Boston, MA (USA), 27 Nov - 2 dec 1989).

Neutron reflectivity has been used to determine the concentration profile at the vacuum-polymer interface for a two polymer blend. To quantify surface enrichment and evaporation due to differences in chain length, we have measured the reflectivity of a mixture of short deuterated and long protonated polystyrene chains (DPS and PS), with a weight fraction of 0.5. When a mixture of DPS an PS chains of molecular weight 720 and 910k respectively were annealed, a small but measurable increase in asymptotic reflectivity occurred, coupled with a decrease of film thickness and scattering length density. This is indicative of surface enrichment and evaporation of the light chains (DPS). Ellipsometry studies confirmed that the short chains evaporated and its rate was established as a function of the temperature. Upon increasing the DPS molecular weight to 9600, the enrichment becomes considerably greater whilst the evaporation becomes negligible.

53331 Observation of micellar formation in the cavity of porous silica glass. Bradley, K.F. (Dept. of Physics, Brown Univ., Providence, RI (US)); Chen, S.H.; Thiyagarajan, P. pp. 403-408 of Neutron scattering for materials science. Materials Research Society proceedings: Volume 166. Shapiro, S.M.; Moss, S.C.; Jorgensen, J.D. Materials Research Society, Pittsburgh, PA (USA) (1990). pp. 499 (CONF-891119–: Materials Research Society fall meeting, Boston, MA (USA), 27 Nov - 2 dec 1989).

The small angle neutron scattering intensity distribution from the empty pores of the silica glass Vycor can be satisfactorily interpreted using a simplified late stage spinodal decomposition model if one allows for a distribution of wave numbers in the material's density function. The result confirms that the porosity of the glass is 28% and gives the mean wave number of the density wave to be k_0 - 0.0285 $Å^{-1}$ with a dispersion, $\Delta K/K_0$, of about 0.29. Small angle neutron scattering measurements of the anionic surfactant SDS in the Vycor pores indicate that when the surfactant is introduced into the pores at 80 x CMC in bulk solution, the surfactant forms micelles with the same average micelle separation distance as in the bulk solution, but the distribution of micelle separations is much greater in the glass pores.

53332 Far-infrared optical properties of superconducting $Bi_2Sr_2CaCu_2O_x$ films. Rao, A.M. (Department of Physics and Astronomy, University of Kentucky, Lexington, KY (USA)); Eklund, P.C.; Lehman, G.W.; Face, D.W.; Doll, G.L.; Dresselhaus, G. *Physical Review, B: Condensed Matter (USA),* 42(1): 193-201 (1 Jul 1990). DOE Contract FG05-84ER45151.

The optical reflectance of thin superconducting $Bi_2Sr_2CaCu_2O_x$ (Bi 2:2:1:2) films has been studied in the frequency range 80–48 000 cm^{-1} and the temperature range 5 K<T<300 K. Since the film thickness d is less than the optical skin depth δ, the reflectance from the film-substrate ($SrTiO_3$) interface must be considered in the interpretation of the experimental results. The dielectric function of the superconductor is calculated with use of the model of Leplae, which takes into account the effect of the quasiparticle lifetime. Structure in the reflectivity spectra is identified with Bi 2:2:1:2 phonons, $SrTiO_3$ substrate phonons, and for $T<T_c$, evidence for a superconducting gap is observed. The gap at T=5 K was found to be $2\Delta=35\pm5$ meV $\cong 6k_BT_c$, in good agreement with previous tunneling studies.

53333 Adsorbate-substrate resonant interactions observed for CO on Cu(100) in the far infrared. Hirschmugl, C.J. (National Synchrotron Light Source, Brookhaven National Laboratory, Upton, NY (USA)); Williams, G.P.; Hoffmann, F.M.; Chabal, Y.J. *Physical Review Letters (USA),* 65(4): 480-483 (23 Jul 1990). DOE Contract AC02-76CH00016.

Surface infrared reflection-absorption measurements for CO adsorbed on Cu(100) in the frequency range 200–500 cm^{-1} reveal, in addition to the Cu-CO stretch mode at 345 cm^{-1}, a sharp derivativelike feature at 285 cm^{-1}, assigned to the CO frustrated rotation mode which is usually dipole forbidden. Its infrared activity and Fano line shape arise from coupling to substrate electronic transitions associated with CO-induced surface states.

53334 Demonstration of the effects of interface strain on band offsets in lattice-matched III-V semiconductor superlattices. Nelson, J.S. (Sandia National Laboratories, Albuquerque, New Mexico 87185 (USA)); Kurtz, S.R.; Dawson, L.R.; Lott, J.A. *Applied Physics Letters (USA),* 57(6): 578-580 (6 Aug 1990). DOE Contract AC04-76DP00789.

A first principles total energy self-consistent pseudopotential calculation is used to predict the band offset in the lattice-matched superlattice $InAs/Al_{0.8}Ga_{0.2}As_{0.14}Sb_{0.86}$. We find that inclusion of interface strain changes the character of the band offset from nominally type II to strongly type II. The predicted band offset at the minimum energy configuration is in excellent agreement with the value determined from infrared photoluminescence measurements.

53335 R-curve measurements in PSZ ceramics. Srinivasan, S. (Materials Science and Engineering Department, North Carolina State University, Raleigh, North Carolina 27695-7907 (USA)); Scattergood, R.O. *Journal of Materials Research (USA),* 5(7): 1490-1495 (Jul 1990). DOE Contract FG05-84ER45115.

An indentation-bend failure-stress method was used for measurement of R-curves in a series of PSZ ceramics with varying peak toughness. Dilatational transformation-stress constraints are included in the residual-stress driving force contribution to the applied stress intensity factor. A power-law fit to the form of the R-curve simplifies the analysis. While the resulting curves show the expected form, measured toughness values are high relative to the expected peak toughness. Limitations and the range of applicability of the indentation-bend technique are discussed.

53336 Kinetics of photoresist etching in an electron cyclotron resonance plasma. Carl, D.A. (Department of Chemical Engineering, University of California, Berkeley, CA (USA)); Hess, D.W.; Lieberman, M.A. *Journal of Applied Physics (USA),* 68(4): 1859-1865 (15 Aug 1990). DOE Contract FG03-87ER13727.

An electron cyclotron resonance plasma processing system was used to etch hardbaked KTI-820 photoresist from single crystal silicon wafers, silicon dioxide films and patterned multilayer structures. Etch rates of 1500 nm/minute were observed at a substrate temperature below 373 K in a $P_{forward}$=750 W, 0.13-Pa ECR oxygen plasma with no applied substrate bias. The etch rate increased linearly with increasing power from $P_{forward}$=300–750 W. Etch rate was a complicated function of pressure and residence time, but a modified adsorption-reaction-ion-stimulated desorption rate expression could be used to fit the data. Etch rates decreased for increasing oxygen residence time at low operating pressures due to a combination of polymeric film formation of reaction products and reactant (atomic oxygen) depletion. Maximum etch rates were observed at approximately 0.13 Pa for all residence times. Multilayer photoresist structures were etched at various pressures as well as at a 45° angle to the incident plasma stream. Etch profiles for the variable angle runs indicated that the etch rate was strongly dependent on ion flux. Etch anisotropy increased with decreasing pressure, consistent with increased ion bombardment energy. The degree of anisotropy was, however, limited due to a non-normal component of ion energy, which has been interpreted previously as an ion temperature.

40 CHEMISTRY

Refer also to citation(s) 53196

53337 (CBPF-MO–001/89) **Proceedings of 6. Latin American School on Theoretical Chemistry. v. 2 pt. 2.** Centro Brasileiro de Pesquisas Fisicas (CBPF), Rio de Janeiro, RJ (Brazil). 1988. 190p. (In Portuguese). (CONF-8809499–: 6. Latin American School on Theoretical Chemistry, Rio de Janeiro (Brazil), 11-17 Sep 1988). Source: Available from the Library of the Comissao Nacional de Energia Nuclear, RJ, Brazil.

This book presents an overview of the courses given during the VI Latin American School of Theoretical Chemistry which happened in september 1988 at Rio de Janeiro. (A.C.A.S.).

53338 (CBPF-MO–001/89) **Proceedings of 6. Latin American School on Theoretical Chemistry. v. 2 pt. 1.** Centro Brasileiro de Pesquisas Fisicas (CBPF), Rio de Janeiro, RJ (Brazil). 1988. 210p. (In Portuguese). (CONF-8809499–: 6. Latin American School on Theoretical Chemistry, Rio de Janeiro (Brazil), 11-17 Sep 1988). Source: Available from the Library of the Comissao Nacional de Energia Nuclear, RJ, Brazil.

This book presents an overview of the courses given during the VI Latin American School on Theoretical Chemistry which happened in september 1988 at Rio de Janeiro. (A.C.A.S.).

53339 (DOE/ER–0144/8) **Summaries of FY 1990 research in the chemical sciences.** USDOE Office of Energy Research, Washington, DC (USA). Chemical Sciences Div.; USDOE Office of Scientific and Technical Information, Oak Ridge, TN (USA). Aug 1990. 1p. Sponsored by U.S. DOE Energy Research. Order Number DE90015200. Source: NTIS, PC A07/MF A01 - OSTI; GPO Dep.

This summary book is published annually to provide information on research supported by the Department of Energy's Division of Chemical Sciences, which is one of five Divisions of the Office of Basic Energy Sciences in the Office of Energy Research. These

summaries provide the scientific and technical public as well as the legislative and executive branches of the Government, information, either generally or in some depth, about the Chemical Sciences program. Areas of research supported are indicted in the section headings, the "Selected Topics of General Interest" list, and the summaries themselves. Energy technologies that may be advanced by use of the basic knowledge generated in this program are included in the "Selected Topics of General Interest" list and are often referenced in the summaries.

4001 Analytical and Separations Chemistry

Refer also to citation(s) 52764, 52771, 52773, 52774, 52776, 52785, 52797, 53188, 53192, 53238, 53281, 53330, 53401, 53403, 53546, 53703, 53704, 53946, 53961, 53965, 54106, 54113, 54114, 54126, 54170, 54211, 54285

53340 (BNL–45184) **$Ru_3(CO)_{12}$ and $Mo(CO)_6$ adsorbed on Ru(001) and Au/Ru: An infrared reflection-absorption study.** Malik, I.J.; Hrbek, J. Brookhaven National Lab., Upton, NY (USA). [1990]. 10p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. (CONF-900914–2: Vibrations at surfaces, Shelter Island, NY (USA), 10-14 Sep 1990). Order Number DE91001128. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

We obtained IRAS and TDS data for $Ru_3(CO)_{12}$/Ru(001) and $Mo(CO)_6$/Au/Ru systems for metal carbonyl coverages between submonolayer and approximately 20 monolayers. We characterized the C-O stretching mode of both systems (4 cm^{-1} FWHM) and a deformation mode of $Mo(CO)_6$ at 608 cm^{-1} (1 cm^{-1} FWHM). Both IRAS and TDS data suggest adsorption and desorption of metal carbonyls as molecular species with a preferential orientation in the overlayers. The IR intensity of the C-O stretch per a C-O bond projected onto the surface normal is approximately twice (five times) larger for $Ru_3(CO)_{12}$ ($Mo(CO)_6$) at submonolayer coverages than for CO/Ru(001) at θ_{CO}=0.68. 31 refs., 4 figs.

53341 (CDTN–ASPC.CN-001/89, pp. 317-331) **Semi-annual report of Chemical Division of CDTN - July to December 1988.** Ferreira, M.P. Centro de Desenvolvimento da Tecnologia Nuclear (CDTN), Belo Horizonte, MG (Brazil). 1989. (In Portuguese). In *Semi-annual report of Nuclear Technology and Development Center (CDTN) - July to December 1988.* 353p. Order Number DE91606188. Source: NTIS (US Sales Only), PC A16/MF A01; OSTI; INIS.

The main activities developed by the Chemical Division of CDTN are described, including (1) the characterization of rare earths and yttrium; (2) the specification of Cu^{++} selective electrode; (3) chemical characterization of UO_2 sintering pellets; (4) determination of graphitic carbon in cement; (5) determination of lead in blood and urine; and (6) analytical determinations. (C.G.C.).

53342 (CDTN–ASPC.CN-001/89, pp. 332-341) **Semi-annual report of Radiochemical Division of CDTN - July to December 1988.** Sabino, C.V.S. Centro de Desenvolvimento da Tecnologia Nuclear (CDTN), Belo Horizonte, MG (Brazil). 1989. (In Portuguese). In *Semi-annual report of Nuclear Technology and Development Center (CDTN) - July to December 1988.* 353p. Order Number DE91606188. Source: NTIS (US Sales Only), PC A16/MF A01; OSTI; INIS.

The main activities developed by Radiochemical Division of CDTN are described, including the analysis of environmental samples, wastes and biological materials. (C.G.C.).

53343 (CDTN–ASPC.CN-001/89, pp. 306-315) **Semi-annual report of the chemical process division of CDTN - July to December 1988.** Lima Soares, M.L. de. Centro de Desenvolvimento da Tecnologia Nuclear (CDTN), Belo Horizonte, MG (Brazil). 1989. (In Portuguese). In *Semi-annual report of Nuclear Technology and Development Center (CDTN) - July to December 1988.* 353p. Order Number DE91606188. Source: NTIS (US Sales Only), PC A16/MF A01; OSTI; INIS.

The main activities developed by the Chemical Process Division of CDTN are described, including the reconversion of UF_6 to UO_2, the separation and purification of rare earths and the solvent extraction with pulse column. (C.G.C.).

53344 (CEA-CONF–10073) **Nuclear microprobe characterization of surface hardening by precipitation of chromium carbides after laser beam treatment of a Ni-Cr substrate.** Mosbah, M. (Laboratoire d'Analyse par Activation Pierre Sue, Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)); Gosset, J.; Trocellier, P.; Puig, T.; Cantarel, M.; Condat, M. Laboratoire d'Analyse par Activation Pierre-Sue - Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). 1989. 15p. (CONF-891029–: ECASIA 89: European conference on applications of surface and interface analysis, Juan-les-Pins (France), 23-27 Oct 1989). Order Number DE91709420. Source: NTIS (US Sales Only), PC A03/MF A01.

Surface treatment by laser provides interesting solutions to the problem of accelerated wear of materials. The aim of the present study is the characterization of chromium carbides rich surface alloys after laser beam melting of a $Ni_{70}Cr_{30}$ carbon precoated substrate. The carbon profiling of the lasered surface was performed by nuclear microprobe using the $^{12}C(d,p_0)^{13}C$ reaction, Ni and Cr were evaluated by means of PIXE (Particle Induced X Ray Emission). The specificity of the method and the experimental conditions are explained. Wear results are very satisfactory and close to those obtained by injection of chromium carbide powders into the laser beam in the case of a Nimonic alloy: wear rates are divided by two orders of magnitude.

53345 (CEA-CONF–10126) **Hydrogen study in melt inclusions trapped in quartz with nuclear microprobe.** Mosbah, M. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Physico Chimie); Tirira, J.; Gosset, J.; Massiot, P.; Clocchiatti, R. CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Physico-Chimie. 1990. 15p. (CONF-900223–: 2. international conference on nuclear microprobe technology and applications, Melbourne (Australia), 5-9 Feb 1990). Order Number DE91716214. Source: NTIS (US Sales Only), PC A03/MF A01.

Elastic recoil spectrometry induced by 3 MeV helium-4 microbeam has been used to determine hydrogen distribution within melt inclusions trapped in quartz. These minerals were selected from different geological environments: Guadeloupe (West Indies), Pantelleria Island (South Sicily - Italy) and San Pietro (South Sardinia - Italy). Bulk hydrogen contents are calculated (H assumed to be in H_2O form). The knowledge of hydrogen distribution assists both in a better understanding and in the establishment of volcanic dynamism hypotheses. Finally, fluid hydrogen rich inclusions are evidenced and H concentration profile is simulated and reported for the first time in glass inclusion.

53346 (CEA-CONF–10128) **Hydrogen microdetermination in geological materials using elastic recoil detection analysis (ERDA).** Mosbah, M. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Physico Chimie); Tirira, J.; Gosset, J.; Massiot, P.; Clocchiatti, R. CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Physico-Chimie. 1989. 18p. (CONF-8908165–: 5. international conference on PIXE and its analytical applications, Amsterdam (Netherlands), 20-26 Aug 1989). Order Number DE91716215. Source: NTIS (US Sales Only), PC A03/MF A01.

For the first time, hydrogen has been determined (by means of nuclear microanalysis) within glassy inclusions trapped in volcanic minerals. Elastic recoil detection of protons has been used by means of the transmission and reflexion geometry. The two major originalities of this work consist in the quantitative absolute method and the application of this technique to natural materials. Some of our results are close to those obtained with other methods. We reached a detection limit < 50 $\mu g/g$ within the San Carlos olivine.

53347 (CEA-CONF–10133) **3D hydrogen profiling by elastic recoil detection analysis.** Constantini, J.M. (CEA Centre d'Etudes de Bruyeres-le-Chatel, 91 (France)); Mori, V.; Tirira, J.; Trocellier, P.; Massiot, P.; Frontier, J.P. CEA Centre d'Etudes de Bruyeres-le-Chatel, 91 (France). 1989. 15p. (CONF-8909372–: European Conference on Accelerator Applications in Research, Francfort, DE (USA), 5-9 Sep 1989). Order Number DE91716216. Source: NTIS (US Sales Only), PC A03/MF A01.

An analytical procedure and a simulation-optimization algorithm are used for hydrogen determination based on Elastic Recoil Detection induced by low energy ^4He ions ($\leq$ 3 MeV) using a transmission geometry. Hydrogen concentration depth profiles can be derived from the experimental recoil spectra for a depth range of up to 6 μm with a resolution better than 40 nm at the surface. The method is then applied to thin polyimide films irradiated by high energy heavy ions. The 3D hydrogen distribution is determined and the presence of hydrogen bubbles diffusing under microbeam impact is shown.

53348 (CNIC–00133) **Preparation of PVC membrane tetrathionate ion selective electrode and its application to the uranium hydrometallurgy.** Zhou Jinfan (Ministry of Nuclear Industry, Beijing, BJ (China). Research Inst. of Uranium Ore Processing); Peng Lusheng; Yin Yinyao. China Nuclear Information Centre, Beijing, BJ (China). 1988. 7p. (In Chinese). (BRIUOP–0006). Order Number DE91605560. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

An experimental study of the tetrathionate ion selective electrode based on PVC matrix membrance containing the quaternary ammonium salts was described. The optimum membrane composition is 2% triheptyl dodecyl ammonium (THDDA), 68% di-(ethylhexyl) phthalate (DEHP) and 30% PVC (w/w). The respose to $S_4O_6^{2-}$ ion is linear with a Nernstian slope over the concentration range 1 x 10^{-1} to 1 x 10^{-5} mol/L and the limit of detection is 1 x 10^{-6} mol/L. The membrane potential was independent on pH from 4.5 to 10. The coefficient of selectivity of various anions were determined, i.e. $S_2O_6^{2-}$: 4.4 x 10^{-3}; $S_3O_6^{2-}$; 1.4 x 10^{-1}; So_4^{2-}; $S_2O_3^{2-}$; $S_2O_3^{2-}$ and SO_3^{2-} : 10^{-5}. The tetrathionate content in alkaline leaching solution of uranium ore can be determined directly by $S_4O_6^{2-}$ · PVC ion selective electrode. The determination limit of $S_4O_6^{2-}$ is 10 mg $S_4O_6^{2-}$/L. The relative standard deviation is ± 10%.

53349 (CNIC–00309) **Application of laser microspectral analysis in geological survey of uranium deposit.** Gong Wenshu (Bureau of Geological Prospection and Exploration of South China, GD (China)); Huang Weiliang; Liu Wenkai; Han Fuying. China Nuclear Information Centre, Beijing, BJ (China). Aug 1989. 7p. (In Chinese). (BGPS–0003). Order Number DE91605561. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

Application of laser microspectral analysis in geologic survey of uranium deposit is described by means of case history. It is not only a quick and reliable method to determine composition of uranium microminerals but a quick and economic means to study rock formation and mineralization.

53350 (CNIC–00320) **The determination of initial ratio of strontium isotope in rocks and its geological application.** Ying Junlong (Ministry of Nuclear Industry, Beijing, BJ (China). Beijing Inst. of Uranium Geology); Zhao Puyun; Lin Xiulan. China Nuclear Information Centre, Beijing, BJ (China). Apr 1989. 9p. (In Chinese). (BUGRI–0006). Order Number DE91605535. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

The method to determine the initial ratio of strontium isotopes existed in rocks of poor rubidium and rich strontium and main carrier minerals is introduced. The initial ratio obtained from this method is equivalent to that acquired by Rb-Sr isochrone. Based on this result, information on regional rock genesis and mineralization regularities can be provided. It has great significance in the research on activities of ancient continental margin and material sources as well as their evolution. The migration of rock, and ore-forming materials, matallogenetic mechanism and its distribution in the space and time evolution are studied by using these data. In conclusion, the determination of strontium isotopes has broad prospects in the geological research.

53351 (CNIC-I–004, pp. 57) **Determination of the isotopic ratio of $^{13}C/^{12}C$ by PIGE.** Zhang Weicheng; Zeng Wenbing; Zhang Tianmei; Lei Xiangguo; Yang Zhengguo; Li Zhengkun. China Nuclear Information Centre, Beijing, BJ (China); Academia Sinica, Lanzhou, GS (China). Inst. of Modern Physics. Jun 1990. In *IMP annual report, 1988 (January-December).* 138p. Order Number DE91606195. Source: NTIS (US Sales Only), PC A07/MF A01; OSTI; INIS.

Published in summary form only. ISOTOPE RATIO/carbon 12; ISOTOPE RATIO/carbon 13; NUCLEAR REACTION ANALYSIS/carbon 12; NUCLEAR REACTION ANALYSIS/carbon 13; ACCURACY; BREATH; CARBON 12 TARGET; CARBON 13 TARGET; PROMPT GAMMA RADIATION; PROTON REACTIONS

53352 (CNIC-I–004, pp. 64-65) **AES analysis of ^{14}N ions implantation layer.** Xiao Guoqing; Wu Meizhen; Hou Mingdong; Wang Shufen. China Nuclear Information Centre, Beijing, BJ (China); Academia Sinica, Lanzhou, GS (China). Inst. of Modern Physics. Jun 1990. In *IMP annual report, 1988 (January-December).* 138p. Order Number DE91606195. Source: NTIS (US Sales Only), PC A07/MF A01; OSTI; INIS.

Published in summary form only. AUGER ELECTRON SPECTROSCOPY/layers; ION IMPLANTATION/layers; LAYERS; CARBON; DEPTH; KEV RANGE 10-100; NITROGEN; NITROGEN 14 BEAMS; OXYGEN; RADIATION DOSES; SPATIAL DISTRIBUTION; SPUTTERING; STEELS; THICKNESS

53353 (CNIC-I–004, pp. 68-69) **Analysis of content percent of elements P, Rh in the catalyst using PIXE method.** Jiang Xinzhou; Yin Zhongli; Zhang Shumin; Wang Shujing; Ma Chengjun; Liang Qiang; Li Zhengkun. China Nuclear Information Centre, Beijing, BJ (China); Academia Sinica, Lanzhou, GS (China). Inst. of Modern Physics. Jun 1990. In *IMP annual report, 1988 (January-December).* 138p. Order Number DE91606195. Source: NTIS (US Sales Only), PC A07/MF A01; OSTI; INIS.

Published in summary form only. CATALYSTS/pixe analysis; CALIBRATION STANDARDS; CATALYSTS; MOLECULAR STRUCTURE; PHOSPHORUS; QUANTITY RATIO; RHODIUM; SPECTRA

53354 (CNIC-I–004, pp. 71-72) **Multi-element analysis of 12 Chinese geological samples and Elbe water by total-reflection X-ray fluorescence.** Tian Yuhong; Boeddeker; Hui, R.Y. China Nuclear Information Centre, Beijing, BJ (China); Academia Sinica, Lanzhou, GS (China). Inst. of Modern Physics. Jun 1990. In *IMP annual report, 1988 (January-December).* 138p. Order Number DE91606195. Source: NTIS (US Sales Only), PC A07/MF A01; OSTI; INIS.

Published in summary form only. MINERALS/x-ray fluorescence analysis; WATER/x-ray fluorescence analysis; CALIBRATION STANDARDS; CHINA; EUROPE; EXPERIMENTAL DATA; MINERALS; MULTI-ELEMENT ANALYSIS; QUANTITY RATIO; REFLECTION; RIVERS; WATER

53355 (CONF-9006277–1) **Progress in the detection of single molecules in levitated droplets.** Whitten, W.B. (Oak Ridge National Lab., TN (USA)); Ramsey, J.M.; Arnold, S.; Bronk, B.V. Oak Ridge National Lab., TN (USA). [1990]. 3p. Sponsored by U.S. Department of Defense; U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From U.S. army chemical research development and engineering conference on aerosols and obscuration; Aberdeen, MD (USA); 25-27 Jun 1990. Order Number DE91000612. Source: NTIS, PC A01/MF A01 - OSTI; GPO Dep.

This report briefly describes a method for the detection of single molecules of rhodamine-6G in levitated droplets. 4 refs. CBS

53356 (EUR–12609) **European interlaboratory test measurements on alpha-contaminated waste.** Dierckx, R. (Commission of the European Communities, Ispra (IT). Joint Research Centre); Bondar, L.; Bosser, R.; Bremer, W.B.; Cresti, P.; Vicini, C.; Filss, P.; Leake, J.W.; Ottmar, H. Commission of the European Communities, Luxembourg (Luxembourg). 1990. 112p. Contracts Nos WAS 182-81-42 F;WAS 412-83-42 F;WAS 184-81-43 D;WA Source: NTIS (US Sales Only), PC A06/MF A01.

The Commission of the European Communities has organized interlaboratory test measurements on alpha-contaminated waste. The intention was to compare methods and tools used in different laboratories and to determine the plutonium content of real waste drums. Seven laboratories from the Community participated. The exercise consisted in measuring drums in which sources of known Pu-content and composition were placed in defined positions. Furthermore, a total of nine sealed drums with unknown Pu-content and composition had to be measured and the Pu-content determined. The measurements show that more work has to be done. The stated uncertainties are not always realistic. A good calibration

is necessary, taking into account matrix and source position effects. The correction for matrix and source position effects proved to be very important and has to be investigated further.

53357 (GKSS–90/E/15) **Multielement analysis of archaic Chinese bronze and antique coins by fast neutron activation analysis.** Tian, Y.H. (Academia Sinica, Lanzhou, Gansu (China). Inst. of Modern Physics); Pepelnik, R.; Fanger, H.U. GKSS-Forschungszentrum Geesthacht GmbH, Geesthacht-Tesperhude (Germany, F.R.). 1990. 12p. Source: Special print from J. Radioanal. Nucl. Chem. (1990) v. 139(1) p. 43-53.

Samples of archaic bronze have been investigated by fast neutron activation analysis using both the absolute and relative method. The components Cu, Zn, Sn and Pb have been determined quantitatively. For the detection of lead via the short-lived isomeric state ^{207m}Pb, cyclic activation and measurement technique was used with pneumatic sample transfer between detector and central irradiation position of the neutron tube. For non-destructive analysis of antique Chinese coins the samples had to be irradiated outside the neutron generator KORONA. The activation reactions, the evaluation of the elemental concentrations and the accuracy of the results are discussed. The data were corrected for γ-ray self-absorption in the samples and summing of coincident γ-rays in the detector. According to reported typical compositions of Chinese bronze from different dynasties, the age of the samples has been derived from the results obtained. (orig.).

53358 (IAEA-RL–45) **Report on the intercomparison run F-1 U and K(Th) in feldspar.** International Atomic Energy Agency, Seibersdorf (Austria). Analytical Quality Control Services. 7 Aug 1990. 21p. Order Number DE91605536. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

This report deals with a recent intercomparison on the determination of U, Th, and K in potassium feldspar, carried out in 1976-77 and involving the participation of 20 institutes who returned a total of 196 individual results on three elements. Analytical techniques employed by the participating institutes included gamma spectrometry, emission spectroscopy, atomic absorption, X-ray fluorescence, fluorimetry and neutron activation. Each of these techniques has its own particular weakness: The basic principles of gamma-spectrometric technique for the determination of U, Th and K are well known. It is, however, difficult to determine the low concentrations of radioactive nuclides which can be found in geological materials due to systematic errors arising from non-equilibration of decay chains in the samples and from other sources including calibration. Determination of uranium in geological materials by non-destructive neutron activation analysis also has some problems. Elements such as Th, Ta, Pt, Ru, Zn and Ba when irradiated in a nuclear reactor with thermal and epithermal neutrons yield radioactive isotopes, the gamma rays of which interfere with those used in uranium determination. Detection limits for three elements U, Th and K for thermal neutron activation have been reported as 0.7, 1.0 and 10 ppb respectively, however, this seems over-optimistic to expect in real-life situations. Measurement of delayed neutrons and fission track methods for uranium and thorium also have interference problems. Fluorimetry is a suitable method for uranium at low concentrations (down to 0.1 ppm) but one has to take care to overcome quenching by removing, or at least diluting, interfering elements. The determination of some important elements in geochemical samples is often difficult because of their small concentration as well as of the presence of interfering matrix elements in the samples. (Abstract Truncated)

53359 (IAEA-RL–128(Rev.1)) **Biological and environmental reference materials for trace elements, nuclides and organic microcontaminants: A survey.** Cortes Toro, E.; Parr, R.M.; Clements, S.A. International Atomic Energy Agency, Vienna (Austria). 1990. 114p. Order Number DE91605563. Source: NTIS (US Sales Only), PC A06/MF A01; OSTI; INIS.

This report has been produced from a database on analytical reference materials of biological and environmental origin, which is maintained at the International Atomic Energy Agency. It is an updated version of an earlier report, published in 1985, which focussed mainly on reference materials for trace elements. In the present version of the report, reference materials for trace elements still constitute the major part of the data; however, information is also now included on a number of other selected analytes of relevance to IAEA programmes, i.e. radionuclides, stable isotopes and organic microcontaminants. The database presently contains 2,694 analyte values for 117 analytes in 116 biological and 77 environmental (non-biological) reference materials produced by 20 different suppliers. Additional information on the cost of the material, the unit size supplied, (weight or volume), and the minimum weight of material recommended for analysis is also provided (if available to the authors). It is expected that this report will help analysts to select the reference material that matches as closely as possible, with respect to matrix type and concentrations of the analytes of interest, the "real" samples that are to be analysed. Refs, 12 tabs.

53360 (IPEN-PUB–293) **Determination of impurities in zirconium oxide by neutron activation analysis.** Oliveira Lellis, L. de; Saiki, M.; Yamagata, C. Instituto de Pesquisas Energeticas e Nucleares (IPEN), Sao Paulo, SP (Brazil). Feb 1990. 15p. Order Number DE91605538. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

The instrumental method of neutron activation analysis was applied to the determination of impurities in zirconium oxide samples produced at IPEN-CNEN/SP. The samples and the standards of the elements to be determined were irradiated in the IEA-R1 research reactor under a thermal neutron flux from 10^{11} to 10^{12} n.cm^{-2}.s^{-1} for a period that varied from 3 min to 8 h and after adequate cooling time they were counted in a Ge(Li) detector coupled to a multichannel analyzer. The impurities of Al, Dy, Eu, Fe, Hf, Mn, Sc, Ta, Tb, Th and V were determined quantitatively in zirconium oxide samples. The relative standard deviations of the results for several impurities were, in general, lower than 15%. In order to investigate the accuracy obtainable with the method a standard reference material Zircaloy 2 - SRM-360a from NIST was analysed. The quantitative determination limit was also evaluated for impurities present in zirconium oxide samples. (author).

53361 (IPEN-PUB–310) **Multielemental determination in Citrus spp bee honey samples by instrumental neutron activation analysis.** Favaro, D.I.T.; Vasconcellos, M.B.A.; Pamplona, B. Instituto de Pesquisas Energeticas e Nucleares (IPEN), Sao Paulo, SP (Brazil). Jul 1990. 18p. (In Portuguese). Order Number DE91605539. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

Recently interest has grown in the determination of the concentration of inorganic chemical elements in honey bee samples, due its utilization as indicator of environmental pollution in several countries of Europe. In the present work, a method was developed to determine some essential and potentially inorganic elements in honey bee samples by intrumental neutrons activation analysis followed by high resolution gamma ray spectrometry. The honey samples were neutron irradiated during differents times at the nuclear research reactor IEA-RI of the IPEN-CNEN/SP. The elements Na, Cl, K, Mg and Mn were determined using irradiations of 30 minutes under a thermal neutron flux of 10^{12} n.cm^{-2}.s^{-1}. With 16 hours of irradiation under a flux of 10^{13} n.cm^{-2}.s^{-1} and different cooling times, the elements Br, Ca, Au, Sb, Cs, Rb, Zn, Sc, Fe, Co and La were determined. The concentration of the analyzed elements ranged from ng/g to mg/g. In the future, different kinds of bee honey will be analyzed and the characteristic chemical composition of each one will be established. Based on these elemental concentration data, the relationship between the mineral composition of bee honey and its geographical origin can be studied. (author).

53362 (ORNL/FTR–3773) **[Resonance ionization spectroscopy and its applications]: Foreign trip report, September 15, 1990–September 30, 1990.** Ramsey, J.M. Oak Ridge National Lab., TN (USA). 11 Oct 1990. 6p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE91001150. Source: NTIS, PC A01/MF A01 - OSTI; GPO Dep.

The Fifth International Symposium in Resonance Ionization Spectroscopy and Its Applications was attended. The Joint Research Centre of the European Communities at Ispra, Italy was also visited. The traveler presented an invited talk, chaired a meeting session and gave an impromptu presentation on how current laser technology limits the development of commercial instrumentation based upon Resonance Ionization Spectroscopy. The conference was truely international with scientists from 19 countries

and less than 1/4 from the US. The meeting also provided a health mixture of experimentalists and theoreticians. Technical developments reported included the use of electric field ionization from laser prepared Rydberg states as a way to reduce background signals and commercial development of an optical parametric oscillator for replacing pulsed dye laser. A speaker from the Soviet Union suggested their willingness to market hardware they have developed based upon the resonance ionization technique.

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Refer also to citation(s) 52747, 52873, 53213, 53271, 53312, 53318, 53382, 53383, 53402, 53552, 53563, 53703, 53968, 54221

53363 (CNIC-I-004, pp. 49-50) **Preparation and analysis of sodium titanate.** Niu Fang; Ma Taotao; Sun Xiuhua. China Nuclear Information Centre, Beijing, BJ (China); Academia Sinica, Lanzhou, GS (China). Inst. of Modern Physics. Jun 1990. In *IMP annual report, 1988 (January-December).* 138p. Order Number DE91606195. Source: NTIS (US Sales Only), PC A07/MF A01; OSTI; INIS.

Published in summary form only. SODIUM COMPOUNDS/chemical preparation; SODIUM COMPOUNDS/structural chemical analysis; TITANATES/chemical preparation; TITANATES/structural chemical analysis; CHEMICAL COMPOSITION; CHEMICAL PROPERTIES; CHEMICAL REACTIONS; DIFFERENTIAL THERMAL ANALYSIS; GRAVIMETRIC ANALYSIS; INORGANIC ION EXCHANGERS; SODIUM HYDROXIDES; TITANATES; TITANIUM COMPOUNDS; X-RAY DIFFRACTION; X-RAY FLUORESCENCE ANALYSIS

53364 (DOE/ER/13460–4) **Energies of organic compounds: Progress report.** Yale Univ., New Haven, CT (USA). [1990]. 9p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-86ER13460. Order Number DE91001252. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The enthalpy of reduction of lactones to the corresponding diols has been determined, allowing the enthalpies of formation of the lactones to be determined. The results of this study agree well with the data we have obtained for the enthalpies of hydrolysis of the lactones. We have begun the measurement of the enthalpies of reduction of norbornanones, and we have shown that it is possible to determine the difference in energy between the exo and endo forms of the product alcohols by measuring the equilibrium constant as a function of temperature. The study of the enthalpies of hydration of carbonly compounds has continued, and the enthalpies of hydrolysis of the corresponding ketals is being determined. The study of the enthalpies of hydration of alkenes is nearly completed, and the rearrangement reactions which were uncovered are being investigated.

53365 (DOE/ER/13579–22) **Variational transition state theory.** Truhlar, D.G. Minnesota Univ., Minneapolis, MN (USA). Dept. of Chemistry. [1990]. 4p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-86ER13579. Order Number DE91001253. Source: NTIS, PC A01/MF A01 - OSTI; GPO Dep.

In recent years our research group has made a systematic effort to study the validity of transition state theory (TST). We have found that the conventional theory is sometimes remarkably accurate, but in many other cases it leads to large errors. Fortunately we have found that a much more reliable theory that has many of the advantages of conventional TST can also be formulated, and it can be applied to practical problems with an effort that is much closer to that required for conventional transition state theory than to that required for quantal dynamics calculations. The two most important features in the improved approach to transition state theory state theory are the variational determination of the transition state and the incorporation of tunneling contributions by multidimensional semiclassical approximations. 13 refs.

53366 (DOE/ER/13582–4) **Study of improved methods for predicting chemical equilibria: Technical progress report, July 1, 1989–August 31, 1990.** Lenz, T.G. (Colorado State Univ., Fort Collins, CO (USA). Dept. of Chemical Engineering); Vaughan, J.D. Colorado State Univ., Fort Collins, CO (USA). 1990. 6p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-86ER13582. Order Number DE91000263. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The objective of the research during the current and preceding periods has been to calculate thermodynamic properties ($\Delta H°$, $\Delta S°$, and $\Delta G°$) of typical organic reactions in solution with sufficient accuracy to provide a viable alternative to expensive, time-consuming laboratory experimentation. The research has proceeded along five pathways. (1) Calculation of the thermodynamic properties $\Delta H_f°$, $C_p°$, $(H_o - H_c°)/T$, and $S°$ for reactants and products in the gas phase. Transformation of gas phase thermodynamic properties of reactants and products into condensed phase properties by use of observed vapor pressure data. (3) Experimental determination of X-ray crystal structures, vapor and sublimation pressures, and calorimetric standard enthalpies of formation of large, relatively complicated reactants and products, such as Diels-Alder adducts of substituted anthracenes and substituted maleic anhydrides. (4) Experimental determination of equilibrium constants of Diels-Alder reactions of complicated, strained dienes and dienophiles over a range of temperatures in liquid solution. (5) Molecular dynamics study of pure liquids and liquid mixtures the to eventually permit a new activity coefficient models being developed.

53367 (DOE/ER/13769–3) **Transport properties of dense fluid mixtures using nonequilibrium molecular dynamics: Progress report.** Murad, S. Illinois Univ., Chicago, IL (USA). Dept. of Chemical Engineering. Sep 1990. 37p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-87ER13769. Order Number DE91000262. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This progress report covers research carried out during the period September 15, 1987–September 15, 1990. The main emphasis of the work was on dense fluid mixtures, although in some cases work had to be done on pure fluids before we could study mixtures in a meaningful way. A summary of our results is given. (1) An algorithm was developed and used to calculate the viscosity and thermal conductivity of continuous, or polydisperse mixtures with various distributions (e.g. linear, several gaussian distributions including unsymmetric, etc.) using nonequilibrium molecular dynamics (NEMD). (2) A method was developed to calculate the thermal conductivity of nonspherical (rigid) molecules using NEMD. (3) The NEMD method for thermal conductivity of nonspherical molecules was used to have a careful look at the contributions due to internal rotational degrees of freedom in linear compounds such as chlorine, nitrogen, etc. (4) It has long been speculated that polar fluids exhibit heat induced birefringence, i.e., the molecules will tend to align themselves along the direction of an external heat field. Using nonequilibrium molecular dynamics we were able to conclusively confirm this. (5) We completed a preliminary study of the viscosity of homonuclear diatomics and their mixtures (e.g. N_2, Cl_2, etc.). (6) We completed a study of the various flexibility (vibrational) effects, such as bond bending, bond stretching etc., on linear and nonlinear model triatomics. To examine these effects in our preliminary study, we looked at the pressure second virial coefficients.

53368 (DOE/ER/45146–6) **Photoionization and electron transfer in ionic crystals: Annual technical report.** McClure, D.S. Princeton Univ., NJ (USA). Dept. of Chemistry. 11 Sep 1990. 13p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-84ER45146. Order Number DE91001670. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Three lines of work have been completed since our previously submitted proposal. These are: spectroscopy of $Ce^{3+} - Na^+$ pairs in CaF_2 and SrF_2, photoionization studies of Sm^{2+}, Eu^{2+} and Yb^{2+} in CaF_2 and SrF_2; and infrared-detected two-photon spectroscopy of $MgO:Ni^{2+}$, and other two-photon spectroscopy studies. These are discussed in this report.

53369 (DOE/ER/60405–5) **Mechanisms of interaction of radiation with matter: Research progress report, September 1, 1989–August 31, 1990.** New York Univ., NY (USA). Radiation and Solid State Lab. [1990]. 65p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-86ER60405. Order Number DE91001362. Source: NTIS, PC A04/MF A01 - OSTI; GPO Dep.

This progress report is a summary and update of the research performed under DOE grant FG-02086-ER60405 from September 1, 1989 to August 31, 1990. Part I deals with mechanisms of photoemission from organic particulates, theoretical studied of the

photoemission of electrons into atmospheres containing scavenger molecules, and theoretical studies of the possible existence of excitonic ions. Part II deals with the mechanisms of electrolytic reactions which occur at solid anthracene/aqueous electrolyte interfaces. Part III describes our most recent results on the physico-chemical interactions of mutagenic and carcinogenic polycyclic aromatic hydrocarbon (PAH) derivatives with nucleic acids. 3 refs., 14 figs., 2 tabs.

53370 (DOE/ER/60508–3) **A study of the physical-chemical mechanisms and variables which affect the transport of inorganic and organic heterogeneous systems: Final report, December 1986–December 1989.** Anderson, M.A.; Zeltner, W.A. Wisconsin Univ., Madison, WI (USA). Water Chemistry Program. Jul 1990. 13p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-87ER60508. Order Number DE91001304. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

In order to model transport of dissolved ions in subsurface environments, one should understand how these ions interact with solid phase adsorbents. Our primary goal has been investigating the reaction mechanisms which affect microcontaminant partitioning between aqueous solutions and solid phase adsorbents, using goethite (α-FeOOH) as a model adsorbent. Cylindrical internal reflection – Fourier transform infrared (CIR-FTIR) spectroscopy has been developed as the primary technique for this study. Wet chemical adsorption studies, acoustophoresis and electrophoretic mobility have been used to obtain supporting information as needed. Phenol and o-nitrophenol did not adsorb to goethite. Benzoate, phthalate and p-hydroxybenzoate all adsorbed via a bidentate mechanism to two adjacent iron atoms, while salicylate and 2,4-dihydroxybenzoate formed a chelate complex to single iron atoms. Phosphate adsorption was predominately bidentate.

53371 (IFUSP-P–797) **Ferrofluids in liquid crystalline systems.** Figueiredo Neto, A.M. (Sao Paulo Univ., SP (Brazil). Inst. de Fisica); Liebert, L. Sao Paulo Univ., SP (Brazil). Inst. de Fisica. Aug 1989. 21p. Order Number DE91605577. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

It is a well-known fact that intermediate or mesomorphic phase may exist between the crystalline and the isotropic liquid phases. The symmetry properties of these mesophases are intermediate between those of a crystal and a liquid. In this paper, some aspects of the use of ferrofluids in thermotropic and lyotropic systems are studied both the experimental difficulties as well as the fundamental phypical phenomena involved. (A.C.A.S.).

53372 (IS-T–1406) **Observation by flow ^{1}H NMR and dimerization kinetics and products of reactive ortho-quinodimethanes and benzocyclobutadiene.** Fischer, D. Ames Lab., IA (USA). 21 Sep 1990. 145p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-82. Order Number DE91000748. Source: NTIS, PC A08/MF A01; OSTI; INIS; GPO Dep.

The reactive o-quinodimethanes, 1,2-dimethylene-1,2-dihydronaphthalene (9) and o-xylylene (1) were observed by flow ^{1}H NMR spectroscopy at room temperature. The ^{1}H NMR spectrum of 9 was obtained in the absence of precursor and dimers. However, the ^{1}H NMR spectrum of the more reactive 1, generated in a similar manner from [o-((trimethylsilyl)methyl)benzyl]trimethylammonium iodide (5.) could be obtained only in the presence of its stable [4 + 2] and [4 + 4] dimers. The dimerization kinetics of 3-methyl- (5′), 3,6-dimethyl- (11), 3-isopropyl- (12), and 3,6-diisoproply-1,2-xylylene (13) in acetonitrile (CH_3CN) were studied by stopped-flow UV-visible spectroscopy. Fluoride ion induced 1,2-elimination from 2-elimination from 2-trimethylsilylbenzocyclobutenyl-1 mesylate (26) was used to generate the reactive molecule benzocyclobutadiene (1′) in CD_3CN, which was observed by flow ^{1}H NMR spectroscopy at room temperature. The ^{1}H NMR spectrum (in CD_3CN) of 1,2-dimethylene-1,2-dihydrothiophene (1″), obtained by fluoride ion induced 1,4-elimination from 3-(trimethylammoniummethyl)-2-(trimethylsilylmethyl)thiophene iodine was observed by flow ^{1}H NMR spectroscopy at room temperature. The dimerization rate of 1″ in CH_3CN, generated in the same manner, was measured by UV-visible spectroscopy. 166 refs., 7 figs., 7 tabs.

53373 (IS-T–1422) **A search for thermal isomerization of olefins to carbenes: Thermal generations of the silicon-nitrogen double bond.** Zhang, Xianping. Ames Lab., IA (USA). 21 Sep 1990. 159p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-82. Order Number DE91000745. Source: NTIS, PC A08/MF A01 - OSTI; GPO Dep.

The first part of this thesis will search for the thermal isomerization of olefins to carbenes which is predicted to be a high energy process by calculations and has only been observed in a few strained olefins. The possibility of thermal isomerization of simple olefins to carbenes will be explored. Substitution of a silyl group on the double bond of an olefin allows a potential intermediate which has a β-radical to the silyl group during the cis-trans isomerization. The effects of a trimethylsilyl group on this isomerization are the subject of this study. The second part of this thesis will include the generation and chemistry of intermediates containing a silicon-nitrogen double bond. The isomerization of parent silanimine to the aminosilylene was calculated to be a high energy process. New approaches to the silicon-nitrogen double bond will also be presented. 92 refs., 12 figs., 11 tabs.

53374 (IS-T–1442) **Reactions of the excited state of polypyridyl chromium(III) ion.** Steffan, C. Ames Lab., IA (USA). 21 Sep 1990. 176p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-82. Order Number DE91000741. Source: NTIS, PC A10/MF A01 - OSTI; GPO Dep.

There has been much recent interest in the photochemistry and photophysics of transition metal polypyridine complexes due to the possibility of their use in solar energy conversion systems. The excited state of these compounds are known to undergo useful electron transfer and energy transfer reactions. This work attempts to elucidate the mechanism of the quenching of $^*CrL_3^{3+}$ (where L = 2,2′-bipyridine, 4,4′-dimethyl-2,2′-bipyridine, 1,10-phenanthroline, 5-chloro-1,10-phenanthroline, 5-methyl-1,10-phenanthroline) by oxalate ions in neutral pH. Evidence suggests an ion-pairing pre-equilibrium followed by rate limiting electron transfer to produce CrL_3^{2+} and CO_2^- can then react with ground state chromium(III) species to produce another mole of the reduced product or it can produce a secondary transient as in the case of phenanthroline and substituted phenanthroline complexes. The secondary transient reacts to produce CrL_3^{2+} in a subsequent reaction. 85 refs., 24 figs., 7 tabs.

53375 (IS-T–1453) **Platinum(II) complexes as spectroscopic probes for biomolecules.** Ratilla, E. Ames Lab., IA (USA). 21 Sep 1990. 219p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-82. Order Number DE91000747. Source: NTIS, PC A10/MF A01 - OSTI; GPO Dep.

The use of platinum(II) complexes as tags and probes for biomolecules is indeed advantageous for their reactivities can be selective for certain purposes through an interplay of mild reaction conditions and of the ligands bound to the platinum. The use of ^{195}Pt NMR as a method of detecting platinum and its interactions with biomolecules was carried out with the simplest model of platinum(II) tagging to proteins. Variable-temperature ^{195}Pt NMR spectroscopy proved useful in studying the stereodynamics of complex thioethers like methionine. The complex, Pt(trpy)Cl$^+$, with its chromophore has a greater potential for probing proteins. It is a noninvasive and selective tag for histidine and cysteine residues on the surface of cytochrome c at pH 5. The protein derivatives obtained are separable, and the tags are easily quantitated and differentiated through the metal-to-ligand charge transfer bands which are sensitive to the environment of the tag. Increasing the pH to 7.0 led to the modification by Pt(trpy)Cl$^+$of Arg 91 in cytochrome c. Further studies with guanidine-containing ligands as models for arginine modification by Pt(trpy)Cl$^+$ showed that guanidine can act as a terminal ligand and as a bridging ligand. Owing to the potential utility of Pt(trpy)L^{n+} as electron dense probes of nucleic acid structure, interactions of this bis-Pt(trpy)$^{2+}$ complex with nucleic acids was evaluated. Indeed, the complex interacts non-covalently with nucleic acids. Its interactions with DNA are not exactly the same as those of its precedents. Most striking is its ability to form highly immobile bands of DNA upon gel electrophoresis. 232 refs.

53376 (IS-T–1492) **Kinetics and mechanisms of the reactions of alkyl radicals with oxygen and with complexes of**

Co(III), Ru(III), and Ni(III). Kelley, D. Ames Lab., IA (USA). 8 Oct 1990. 167p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-82. Order Number DE91000998. Source: NTIS, PC A09/MF A01; OSTI; INIS; GPO Dep.

The kinetics of the reactions of C_2H_5 radical with $Co(NH_3)_5X^{2+}$, $Ru(NH_3)_5X^{2+}$, and $Co(dmgH)_2$ (X) (Y) (X = Br, Cl, N_3, SCN; Y = H_2O, CH_3CN) complexes were studied using laser flash photolysis of ethylcobalt complexes. The kinetics were obtained by the kinetic probe method. Some relative rate constants were also determined by a competition method based on ethyl halide product ratios. The kinetics of colligation reactions of a series of alkyl radicals with β-Ni(cyclam)$^{2+}$ were studied using flaser flash photolysis of alkylcobalt complexes. Again, the kinetics were obtained by employing the kinetic probe competition method. The kinetics of the unimolecular homolysis of a series of $RNi(cyclam)H_2O^{2+}$ were studied. Activation parameters were obtained for the unimolecular homolysis of $C_2H_5Ni(cyclam)H_2O^{2+}$. Kinetic and thermodynamic data obtained from these reactions were compared with those for the σ-bonded organometallic complexes. The kinetics of the unimolecular homolysis of a series of $RNi(cyclam)H_2O^{2+}$ complexes were studied by monitoring the formation of the oxygen insertion product $RO_2Ni(cyclam)H_2O^{2+}$. The higher rate constants for the reactions of alkyl radicals with oxygen in solution, as compared with those measured in the gas phase, were discussed. 30 refs.

53377 (IS-T–1520) **Synthesis, characterization, and reactivity of sulfided hexanuclear molybdenum cluster compounds.** Spink, D. Ames Lab., IA (USA). 21 Sep 1990. 118p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-82. Order Number DE91000739. Source: NTIS, PC A07/MF A01 - OSTI; GPO Dep.

Hexanuclear molybdenum clusters with mixed chloride and sulfide bridging ligands were prepared by reacting α-$MoCl_2$ with sodium hydrosulfide in the presence of sodium butoxide. The resulting species, $Mo_6Cl_{(8-x)}S_x{\cdot}npy$($x \cong 3.6$, $n \cong 4$, py = pyridine), was pyrophoric and insoluble. The mixed sulfide chloride cluster species $Mo_6S_4Cl_4{\cdot}6OPEt_3$ and $Mo_6S_{\sim 5}Cl_{\sim 3}{\cdot}6PEt_3$ and $Mo_6S_8{\cdot}6PEt_3$ were isolated and characterized. Phosphorus-31 nuclear magnetic resonance, electron paramagnetic resonance, and UV/visible spectra were obtained for each fraction. The completely sulfided cluster, $Mo_6S_8{\cdot}6PEt_3$, was prepared similarly and used in various experiments as a possible precursor to Chevrel phase materials of the type Mo_6S_8 or $M_nMo_6S_8$. With the goal of removing all of the triethylphosphine ligands, $Mo_6S_8{\cdot}6PEt_3$ was reacted with the transition metal carbonyls molybdenum hexacarbonyl and dicobalt octacarbonyl. Reaction on the molecular sulfide cluster with copper(I) chloride in toluene gave a completely insoluble product. The reaction of $Mo_6S_8{\cdot}6PEt_3$ with propylene sulfide gave a product whose infrared spectra showed only very weak peaks associated with coordinated triethylphosphine. The elemental analysis of this product fit the formula $Mo_6S_8{\cdot}5SPEt_3$. Reactivity of the outer ligands of the $Mo_6S_8{\cdot}npy$ and $Mo_6S_8{\cdot}(6-x)PrNH_x$ clusters were investigated. Crystalline $Mo_6S_8{\cdot}6THT$ was recovered from the reaction of the n-propylamine derivative with THT. A crystal structure determination was done. 87 refs., 12 fig., 15 tabs.

53378 (LBL–29484) **Monte Carlo simulations of temperature-programmed and isothermal desorption from single-crystal surfaces.** Lombardo, S.J. (California Inst. of Tech., Pasadena, CA (USA). Dept. of Chemical Engineering). Lawrence Berkeley Lab., CA (USA). Aug 1990. 316p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. Order Number DE91001740. Source: NTIS, PC A14/MF A01 - OSTI; GPO Dep.

The kinetics of temperature-programmed and isothermal desorption have been simulated with a Monte Carlo model. Included in the model are the elementary steps of adsorption, surface diffusion, and desorption. Interactions between adsorbates and the metal as well as interactions between the adsorbates are taken into account with the Bond-Order-Conservation-Morse-Potential method. The shape, number, and location of the TPD peaks predicted by the simulations is shown to be sensitive to the binding energy, coverage, and coordination of the adsorbates. In addition, the occurrence of lateral interactions between adsorbates is seen to strongly effect the distribution of adsorbates is seen to strongly effect the distribution of adsorbates on the surface. Temperature-programmed desorption spectra of a single type of adsorbate have been simulated for the following adsorbate-metal systems: CO on Pd(100); H_2 on Mo(100); and H_2 on Ni(111). The model predictions are in good agreement with experimental observation. TPD spectra have also been simulated for two species coadsorbed on a surface; the model predictions are in qualitative agreement with the experimental results for H_2 coadsorbed with strongly bound atomic species on Mo(100) and Fe(100) surfaces as well as for CO and H_2 coadsorbed on Ni(100) and Rh(100) surfaces. Finally, the desorption kinetics of CO from Pd(100) and Ni(100) in the presence of gas-phase CO have been examined. The effect of pressure is seen to lead to an increase in the rate of desorption relative to the rate observed in the absence of gas-phase CO. This increase arises as a consequence of higher coverages and therefore stronger lateral interactions between the adsorbed CO molecules.

53379 (Risley-Trans–5942) **U_3O_8 oxides and UO_3 hydroxides and oxide hydrates and peroxides.** Keim, R. (Gmelin-Institut fuer Anorganische Chemie und Grenzgebiete in der Max-Planck-Gesellschaft, Frankfurt am Main (Germany, F.R.)). UKAEA Northern Research Labs., Risley (UK). [1989]. 19p. Translation of Gmelin handbook of inorganic chemistry. (Main Series, 8. ed.). Uranium. Supplementary vol. Pt. C2. Published by Springer-Verlag, Berlin, 1978. Source: Available from The British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

Translation of Gmelin handbook of inorganic chemistry. (Main Series, 8. ed.). Uranium. Supplementary vol. Pt. C2. Published by Springer-Verlag, Berlin, 1978.

Hydrates or hydroxides have been confirmed primarily for the hexavalent uranium. Of the tetravalent uranium, the compound $UO_2{\cdot}xH_2O$ is known, the water content of which varies according to the conditions of preparation and drying. Studies of its formation, preparation, structure, magnetic susceptibility and chemical reactions are reviewed. Recent investigations have shown that a hydrate of U_3O_8 probably does not exist and the compound designated in the literature as $U_3O_8xH_2O$ is a hydrate of composition $UO_{2.86}nH_2O$ (where n = 0.5 and 1.5). Investigations of this compound's formation, preparation, optical properties, thermal stability and solubility are reviewed. The existence of four hydrates or hydroxides of uranium trioxide has been confirmed. They are UO_3nH_2O, where n = 0.5, 0.8, 1 and 2. They may be prepared by breaking down $UO_4{\cdot}xH_2O$ by hydrolysis of uranyl salts or hydrothermally from UO_3. Hydrothermal investigations in the range 25°C to 330°C, resulting in a phase diagram for the UO_2^{2+}-UO_3-H_2O system, are reviewed. (UK).

53380 **Thermal kinetics in small systems. II. Generalized Arrhenius plots with applications to the dissociation of benzene and substituted-benzene cations.** Klots, C.E. (Chemical Physics Section, Health and Safety Research Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831-6125 (USA)). *Journal of Chemical Physics (USA)*, 93(4): 2513-2520 (15 Aug 1990). DOE Contract AC05-84OR21400.

Rate constants for the dissociation of isolated benzene and substituted-benzene cations are analyzed. In the first section Arrhenius activation energies are deduced. A primitive version of the adiabatic channel model is then used to reduce these activation energies to their values at zero Kelvin. A value for the heat of formation at that temperature of the $C_6H^+_5$ ion equal to 1130 kJ/mol is reported. Attention is drawn to a remarkable constancy (and also two anomalies) in the frequency factors for these reactions. The predictive capability of the adiabatic channel model is then examined. It is found to yield kinetic isotope effects in good agreement with experiment.

53381 **Instrument for the measurement and determination of chemical pulse column parameters.** Marchant, N.J.; Morgan, J.P. To Dept. of Energy, Washington, DC (USA). USA Patent 4,947,340/A/. 7 Aug 1990. Filed date 31 Aug 1988. USA Patent patents application 7-238,661. Int. Cl. G06F 15/20. 5p. Source: Patent and Trademark Office, Box 9, Washington, DC 20232 (USA).

This patent describes an instrument for monitoring and measuring pneumatic driving force pulse parameters applied to chemical separation pulse columns obtains real time pulse frequency and root mean square amplitude values, calculates column inch values

and compares these values against preset limits to alert column operators to the variations of pulse column operational parameters beyond desired limits. The present invention relates to pulse columns used in solvent extraction processes, and more specifically to a control device for use in regulating and monitoring the operation of a pneumatic pulser designed to provide pulse activity in a nuclear reactor fuel by-product extraction system.

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Refer also to citation(s) 53137, 53139, 53369, 53967, 53973, 54316

53382 (DOE/ER/13666–T2) **Chemically modified electrodes and related solution studies: Technical progress report, September 15, 1989–October 15, 1990.** Elliott, C.M. Colorado State Univ., Fort Collins, CO (USA). Dept. of Chemistry. [1990]. 5p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-87ER13666. Order Number DE91000984. Source: NTIS, PC A01/MF A01 - OSTI; GPO Dep.

This report briefly discusses work done in the following areas of chemically modified electrodes: Spectroscopic studies of the modes of interactions of pyridine containing ligands with metal surfaces; attempted synthesis of gem-dihalide containing polymers for attachment of Mo_2S_4 clusters; Synthesis of oxo-ruthenium dimer complexes as catalysts for H_2 oxidation; and, studies of porphyrin based polymers which catalyze the oxidation (oxygenation) of olefins and benzylic carbons. (JDL)

53383 (IS-T–1450) **Electrocatalysis of anodic and cathodic oxygen-transfer reactions.** Wels, B.R. Ames Lab., IA (USA). 21 Sep 1990. 119p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-82. Order Number DE91000611. Source: NTIS, PC A07/MF A01 - OSTI; GPO Dep.

The electrocatalysis of oxygen-transfer reactions is discussed in two parts. In Part I, the reduction of iodate (IO_3^-) is examined as an example of cathodic oxygen transfer. On oxide-covered Pt electrodes (PtO), a large cathodic current is observed in the presence of IO_3^- to coincide with the reduction of PtO. The total cathodic charge exceeds the amount required for reduction of PtO and IO_3^- to produce an adsorbed product. An electrocatalytic link between reduction of IO_3^- and reduction of PtO is indicated. In addition, on oxide-free Pt electrodes, the reduction of IO_3^- is determined to be sensitive to surface treatment. The electrocatalytic oxidation of CN^- is presented as an example of anodic oxygen transfer in Part II. The voltametric response of CN^- is virtually nonexistent at PbO_2 electrodes. The response is significantly improved by doping PbO_2 with Cu. Cyanide is also oxidized effectively at CuO-film electrodes. Copper is concluded to serve as an adsorption site for CN^-. It is proposed that an oxygen tunneling mechanism comparable to electron tunneling does not occur at the electrode-solution interface. The adsorption of CN^- is therefore considered to be a necessary prerequisite for oxygen transfer. 201 refs., 23 figs., 2 tabs.

53384 (IS-T–1451) **Electrocatalysis of anodic oxygen-transfer reactions at modified lead dioxide electrodes.** Hsiao, Yun-Lin. Ames Lab., IA (USA). 21 Sep 1990. 183p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-82. Order Number DE91000664. Source: NTIS, PC A09/MF A01 - OSTI; GPO Dep.

The electrocatalytic activities were compared for pure and chloride-doped beta-PbO_2 (Cl-PbO_2) films on gold and platinum substrates. Rate constants were increased significantly for oxidations of Mn^{2+}, toluene, benzyl alcohol, dimethylsulphoxide (DMSO) and benzaldehyde in acidic media by the incorporation of Cl^- into the oxide films. These reactions are concluded to occur by the electrocatalytic transfer of oxygen from H_2O to the reaction products. Results of x-ray diffraction studies indicate the Cl-PbO_2 film continues to have the slightly distorted rutile structure of pure beta-PbO_2. The observed electrocatalytic phenomena are concluded to be the beneficial consequence of surface defects generated when Cl^- serves for charge compensation within the surface matrix and, thereby, increases the number of surface sites capable of adsorbing hydroxyl radicals which are transferred in the electrocatalytic O-transfer reactions. 91 refs., 44 figs., 10 tabs.

53385 (K/CSD/TM–89) **BEPLATE—simulation of electrochemical plating.** Giles, G.E. (Oak Ridge K-25 Site, TN (USA)); Gray, L.J.; Bullock, J.S. IV. Oak Ridge National Lab., TN (USA). Sep 1990. 98p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC05-84OT21400. Order Number DE91000512. Source: NTIS, PC A06/MF A01 - OSTI; GPO Dep.

BEPLATE is a FORTRAN code that uses the boundary element method to simulate the electrochemical plating of material on parts, primarily rotating axisymmetric parts. A boundary element technique is used to solve for the local current density and thus the plating rate on the part, which is used to calculate the growth in the plated layer over a user-specified time step. The surface is moved to reflect this growth, and the new surface is used to generate the local current density. This cycle is repeated until the final time specified by the analyst, producing the final plated thickness. BEPLATE includes models for the polarization effects at both the part (cathode) and anode and allows the use of symmetry planes and nonconducting shields. For electroplating simulations, the part shape is normally assumed to be axisymmetric with a centerline along the z-axis. More general part shapes can be analyzed by BEPLATE if the surface growth simulation is not needed. In either case, the shield, anode, and tank geometries are not restricted to specific shapes. This report includes the information required to run BEPLATE, specifically, a brief description of the BEPLATE system including hardware and software requirements, a description of the complete simulation process, discussion of rules for generating models, and additional reference material. This system of codes consists of model generators (PIGS or PATRAN), input processor (BEPIN), the simulation code (BEPLATE) and postprocessing codes (PATRAN or CONPLOT).

4005 Photochemistry

Refer also to citation(s) 52739, 52757, 53369, 53767, 54196

53386 (DOE/ER/13404–5) **The contribution of electronically excited states to the radiation chemistry of organic systems: Progress report, June 30, 1989–April 30, 1990.** Lipsky, S. Minnesota Univ., Minneapolis, MN (USA). Dept. of Chemistry. [1990]. 10p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-85ER13404. Order Number DE91001328. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The absorption of 160 nm light by cyclohexane in mixtures of cyclohexane, benzene and tetraphenylmethylenediamine results in an emission spectrum consisting of the simultaneous fluorescence from all three components. A mechanism for the development of this spectrum and its dependence on benzene concentration is constructed and shown to be quantitatively consistent with the results of independent measurements on the separate components. In the absence of tetraphenylmethylenediamine, the quenching of cyclohexane fluorescence by benzene is found to be well represented by the standard diffusion model but with important contributions from "transient" terms. The fluorescence from both cyclohexane and benzene in their irradiated mixtures has been studied as a function of benzene concentration from $\simeq$0.005 M to 0.1 M. The quenching of the cyclohexane emission by benzene is found to be significantly greater than obtains under optical excitation conditions suggesting an important role for benzene as a scavenger of the geminate ion-pair precursor of the fluorescing state of cyclohexane. From diffusion models, a lower bound is established for the scavenging rate constant. Minima have been located in the excitation spectra of neat cyclohexane and 2,3-dimethylbutane at approximately the positions of their ionization potentials. The implications is that electron + positive ion neutralizations generate excited neutral states at energies lower than the ionization threshold. 17 refs.,

53387 (DOE/ER/13434–5) **Development of laser-ion beam photodissociation methods: Progress report, December 1, 1989–November 30, 1990.** Russell, D.H. Texas A and M Univ., College Station, TX (USA). Dept. of Chemistry. Aug 1990. 5p. Sponsored by U.S. DOE Energy Research. DOE Contract FG05-85ER13434. Order Number DE91000680. Source: NTIS, PC A01/MF A01 - OSTI; GPO Dep.

During this report period our research efforts have concentrated on studies of the dissociation reactions of model peptides and

other biologically important molecules. In addition, a considerable amount of research effort has been directed toward improving the apparatus used for laser-ion beam photodissociation. The instrumental improvements include some changes on the original apparatus, but most of this effort involved designing a second generation laser-ion beam photodissociation instrument.

53388 (DOE/ER/14104–1) **Photogenerated carrier-induced reaction on semiconductor surfaces: Progress report, December 15, 1989–July 30, 1990.** Osgood, R.M. Jr. Columbia Univ., New York, NY (USA). Microelectronics Sciences Labs. Aug 1990. 13p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-90ER14104. Order Number DE91001349. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

We have begun studying the effect of illumination on the chemical interaction of molecular chlorine with a well-defined GaAs(110) surface under ultra-high vacuum (UHV) conditions. We have found that chlorine adsorbs dissociatively at temperatures as low as 85 K. Illumination of molecular chlorine-covered surface at 85 K with 193-nm radiation led to desorption of Cl-atoms accompanied by Cl_2 molecules, as well as formation of $AsCl_2$/$AsCl_3$, which desorbed at 180 K. Illumination with 351-nm excimer-laser radiation caused exclusively Cl-atoms ejection, at a lower rate. It also resulted in smaller amounts of arsenic chloride formed on the surface. No new species were observed when the surface was irradiated with a 535-nm laser. We suggest that the surface reaction is initiated by dissociation of adsorbed molecular chlorine, which we believe, is mediated by photoemission of electrons from the substrate upon 193-nm irradiation. Finally, we have nearly completed the construction of a second UHV system for the study of laser-induced dissociation of metal alkyls on GaAs surfaces. This system will incorporate total-internal-reflection Fourier-transform IR spectroscopy to follow reaction intermediates, a time of flight mass spectrometer, low electron energy diffraction and Auger Electron spectroscopy.

4006 Radiation Chemistry

Refer also to citation(s) 52775, 52871, 53036, 53296, 53297, 53298, 53301, 53957, 53958

53389 (IAEA-TECDOC–551) **Radiation damage to organic materials in nuclear reactors and radiation environments: Proceedings of a final research co-ordination meeting, held in Takasaki, Japan, 17-20 July 1989.** International Atomic Energy Agency, Vienna (Austria). Apr 1990. 163p. (CONF-8907223–: Final research co-ordination meeting on radiation damage to organic materials in nuclear reactors and radiation environments, Takasaki (Japan), 17-20 Jul 1989). Order Number DE91605608. Source: NTIS (US Sales Only), PC A08/MF A01; OSTI; INIS.

The overall objective of the coordinated research programme was the accumulation of knowledge and experimental as well as practical information leading to the development of a more reliable methodology for accelerated aging testing and predictability of long-term behaviour of different basic materials at long exposures to radiation under different environmental and stress conditions. The research coordination meetings were foreseen as forum for exchange of information on current developments. The specific objectives of the CRP were: To promote and coordinate research leading to development of reliable methodology for accelerated aging testing and prediction of long-term, in-service, behaviour of different materials at long time exposure to radiation under different environmental and stress conditions. Significant progress has been made in development (and experimental demonstration) of accelerated aging methodology for radiation induced degradation. These involve: (a) identifying heterogeneous oxidation due to oxygen diffusion effect; (b) eliminating oxygen diffusion effects by using sufficiently low experimental dose rates or oxygen overpressure; (c) development of superposition models for superposing accelerated aging data. Refs, figs and tabs.

53390 (IAEA-TECDOC–551, pp. 11-24) **Radiation-oxidation of polymers.** Clough, R.L. (Sandia National Labs., Albuquerque, NM (USA)); Gillen, K.T. International Atomic Energy Agency, Vienna (Austria). Apr 1990. (CONF-8907223–: Final research co-ordination meeting on radiation damage to organic materials in nuclear reactors and radiation environments, Takasaki (Japan), 17-20 Jul 1989). In *Radiation damage to organic materials in nuclear reactors and radiation environments: Proceedings of a final research co-ordination meeting, held in Takasaki, Japan, 17-20 July 1989.* 163p. Order Number DE91605608. Source: NTIS (US Sales Only), PC A08/MF A01; OSTI; INIS.

Radiation effects on polymers in the presence of air are characterized by complicated phenomena such as dose-rate effects and post-irradiation degradation. Most applications of polymeric materials in radiation environments involve air atmospheres. Taking account of oxidation effects and time-dependent phenomena is a necessity for understanding materials changes which occur during aging, and for dealing with issues of materials lifetime prediction, aging monitoring, materials selection, and material stabilization. Time-dependent radiation-degradation effects can be understood mechanistically in terms of: (1) features of the free radical chain-reaction chemistry underlying the oxidation, and (2) oxygen diffusion effects. A profiling technique has been developed to study heterogeneous degradation resulting from oxygen diffusion, and kinetic schemes have been developed to allow long-term aging predictions from short-term high-dose-rate experiments. These methodologies have been successfully applied for predicting degradation rates of a number of different materials under ambient nuclear environments. Low molecular weight additives which act either as free-radical scavengers or else as energy-scavengers are effective as stabilizers in radiation-oxidation environments. Non-radical oxidation mechanisms, involving species such as ozone, can also be important in the radiation-oxidation of polymers. (author). 14 refs, 13 figs.

53391 (IAEA-TECDOC–551, pp. 25-35) **Recent advances in the radiation chemistry of polymers.** Hill, D.J.T. (Queensland Univ., St. Lucia (Australia). Dept. of Chemistry); Lewis, D.A.; O'Donnell, J.H.; Pomery, P.J.; Whittaker, A.K. International Atomic Energy Agency, Vienna (Austria). Apr 1990. (CONF-8907223–: Final research co-ordination meeting on radiation damage to organic materials in nuclear reactors and radiation environments, Takasaki (Japan), 17-20 Jul 1989). In *Radiation damage to organic materials in nuclear reactors and radiation environments: Proceedings of a final research co-ordination meeting, held in Takasaki, Japan, 17-20 July 1989.* 163p. Order Number DE91605608. Source: NTIS (US Sales Only), PC A08/MF A01; OSTI; INIS.

Radiation chemical yields, G values, for scission and crosslinking in a variety of polymers have been determined indirectly from measurements of soluble fractions using a gel permeation chromatography technique and directly from solid-state 13C NMR spectra. Similar G values have been obtained by both methods for amorphous ethylene-propylene copolymers, indicating random spatial distributions for scission and crosslinking, whereas much greater crosslinking yields have been obtained by NMR in polydiene rubbers and attributed to clustering of crosslinks. Greatly enhanced degradation indicated by increased creep rate and decreased time to failure has been found for irradiation of amorphous thermoplastic polymers, including high-performance polyarylene sulfones, below their glass transition temperatures, Tg, while subjected to tensile stress; this has significant implications for the use of polymer materials in structural applications in radiation environments. (author). 12 refs, 6 figs.

53392 (IAEA-TECDOC–551, pp. 37-53) **Linear energy transfer effects in polymers.** Schnabel, W. (Hahn-Meitner-Institut Berlin GmbH (Germany, F.R.)); Klaumunzer, S. International Atomic Energy Agency, Vienna (Austria). Apr 1990. (CONF-8907223–: Final research co-ordination meeting on radiation damage to organic materials in nuclear reactors and radiation environments, Takasaki (Japan), 17-20 Jul 1989). In *Radiation damage to organic materials in nuclear reactors and radiation environments: Proceedings of a final research co-ordination meeting, held in Takasaki, Japan, 17-20 July 1989.* 163p. Order Number DE91605608. Source: NTIS (US Sales Only), PC A08/MF A01; OSTI; INIS.

Polymethacrylonitrile (PMCN) and polystyrene (PSt) were irradiated in the absence of 0_2 with heavy particle radiations: 275 MeV $_{20}{}^{10N}e^{7+}$ ions, 6.5 MeV $_{40}{}^{18}Ar^{2+}$ ions and 180 MeV $_{40}{}^{18}Ar^{8+}$ ions. In the case of PMCN the 100 eV-yield of main-chain scission was found to decrease with increasing LET, (-dE/dx in MeV/μm): G(S)

= 3.3-3.6 at -dE/dx = $2x10^{-4}$ (^{60}Co-γ-rays), G(S) = 0.5 at -dE/dx = 0.43 (Ne^{7+} ions) and G(S) = 0.4 at -dE/dx = 2.5 (Ar^{8+} ions). In the case of PSt the 100 eV-yield of crosslinks was found to be independent of LET within the error limit of the measurements: G(X) = 0.05 at -dE/dx = $2x10^{-4}$ (^{60}Co-γ-rays), G(X) = 0.05 at -dE/dx = 0.37 (Ne^{7+} ions), G(X) = 0.04 at -dE/dx = 2.2 (Ar^{2+} ions) and G(X) = 0.04 at -dE/dx = 2.3 (Ar^{8+} ions). These results are critically discussed with respect to up to 100-times higher G(X) values reported by other researchers for irradiation of PSt with LET radiations. The dependence of G(S) on -dE/dx observed with PMCN, and also with polymethylmethacrylate, is explained in terms of an increasing probability of radical-radical reactions and an increasing probability of ionizations and excitations occurring in neighboring repeating units with increasing LET of the radiation. The independence of G(X) found for PSt is explained in terms of crosslinking being a free radical process. Therefore, radical-radical reactions do not become more probable with increasing LET in this case. -Poly-2-chloroethylmethacrylate (PMCMA) turned out to b a probe material for evidencing pronounced temperature increases in the polymer sample during irradiation at high LET: PMCMA was crosslinked to an insoluble gel, if not cooled carefully during irradiation. It underwent predominant main-chain scission, however, if sufficiently cooled. 25 refs, 6 figs, 5 tabs.

53393 (IAEA-TECDOC–551, pp. 55-66) **Irradiation effects of polymer model compounds.** Seguchi, T. (Japan Atomic Energy Research Inst., Takasaki, Gunma (Japan). Takasaki Radiation Chemistry Research Establishment); Hayakawa, N.; Tamura, N.; Katsumura, Y.; Hayashi, N.; Tabata, Y. International Atomic Energy Agency, Vienna (Austria). Apr 1990. (CONF-8907223–: Final research co-ordination meeting on radiation damage to organic materials in nuclear reactors and radiation environments, Takasaki (Japan), 17-20 Jul 1989). In *Radiation damage to organic materials in nuclear reactors and radiation environments: Proceedings of a final research co-ordination meeting, held in Takasaki, Japan, 17-20 July 1989.* 163p. Order Number DE91605608. Source: NTIS (US Sales Only), PC A08/MF A01; OSTI; INIS.

Irradiation effects of n-paraffins and squalane as the model compounds of polymers were investigated by products analysis. Four n-paraffins of $C_{20}H_{42}$,$C_{21}H_{44}$, $C_{23}H_{48}$, and $C_{24}H_{50}$, and squalane ($C_{30}H_{62}$) were irradiated by gamma rays under vacuum in crystalline and liquid or glassy state. The evolved gases were analyzed by gas chromatography and the changes of molecular weight were analyzed by liquid chromatography and mass spectroscopy. The G-values of crosslinking of n-paraffins were 1.2 for crystalline state and 1.7 for liquid state irradiation, and showed no difference among the odd and even carbons. The G-value of squalane was 1.7 for liquid state and 1.3 in glassy state at low temperature of -77 deg. C. The double bonds were much accumulated in the crosslinked products, especially in liquid phase irradiation. The probability of chain scission was estimated negligible, because the small amount of chain scission products were only observed by gas analysis, and the most of them were the products of scission at chain end. (author). 8 refs, 7 figs, 3 tabs.

53394 (IPEN-PUB–292) **The effect of pre-heating and pre-irradiation with gamma-rays on thermal annealing in-bis-[n-benzoil-n-(o) tolylhydroxylaminate] cooper (II).** Nakanishi, C.; Silva, C.P.G. da. Instituto de Pesquisas Energeticas e Nucleares (IPEN), Sao Paulo, SP (Brazil). Feb 1990. 23p. (In Portuguese). Order Number DE91605613. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

The main purpose of this work was to make a contribution on the study of the chemical effects of the (N,γ) reaction on copper chelate. The influence of some factors such as pre-heating and pre-irradiation with gama-rays on the retention and thermal annealing of bis [N-benzoyl-N-(o)tolylhydroxylaminate] copper (II) was investigated. The complex was synthesized and later characterized by means of: determination of the melting-point, elemental analysis, infra-red and visible range absortion spectrophotometry. The compound was heated and also irradiated with gamma-rays in order to verify the effect of thermolysis on the retention. It seems that heat and gamma-radiaition can produce deffects which will lower the susceptibility of the compound to thermal annealling. On the basis on the model envolving electronic species some explanation of ours results were made and a mechanism was proposed for the retention and thermal annealing assuming the capture of free electrons and also the existence of holes. (author).

4007 Radiochemistry and Nuclear Chemistry

Refer also to citation(s) 53086, 53087, 53235, 53793, 53806, 53840, 53956, 53957, 53958, 54196

53395 (BMU–1990-267) **Experiments on the decontamination of urban construction materials.** Schriftenreihe Reaktorsicherheit und Strahlenschutz. Ergebnisberichte, Untersuchungen, Studien, Gutachten. Witt, H. de; Goldammer, W.; Brenk, H.D. Brenk Systemplanung Ingenieurbuero fuer Wissenschaftlich-Technischen Umweltschutz, Aachen (Germany, F.R.); Bundesministerium fuer Umwelt-, Naturschutz und Reaktorsicherheit, Bonn (Germany, F.R.). Aug 1989. 194p. (In German). Contract BMU St.Sch. 1021. Source: Available from GRM Werbeberatung - Werbemittlung - PR, Eggenstein-Leopoldshafen, (Germany, F.R.).

This study discusses the removal of radionuclides from urban construction materials by weathering and forced decontamination. With respect to intermediate and long-term exposure external irradiation due to deposited radio cesium causes the major contribution after nuclear accidents. Therefore, an experimental program was designed and conducted to study the removal of Cs 137 from selected impervious urban surfaces in more detail. The objective of the experiments was to reveal important factors which influence the decontamination process. Particular effort was spent on the investigation of the utilization of ion exchange processes as a forced decontamination technique. The interpretation of the results is presented on the basis of a model which was set up in order to discriminate between the influence of the important physical and chemical processes. The purpose of this description is not only the understanding of the decontamination procedure but mainly the development of better decontamination techniques by a specific manipulation of the relevant processes. (orig.).

53396 (CNIC-I–004, pp. 50-52) **Adsorption studies of Th^{4+} on STB.** Niu Fang; Ma Taotao; Sun Xiuhua. China Nuclear Information Centre, Beijing, BJ (China); Academia Sinica, Lanzhou, GS (China). Inst. of Modern Physics. Jun 1990. In *IMP annual report, 1988 (January-December).* 138p. Order Number DE91606195. Source: NTIS (US Sales Only), PC A07/MF A01; OSTI; INIS.

Published in summary form only. THORIUM COMPOUNDS/adsorption; EQUILIBRIUM; INORGANIC ION EXCHANGERS; PH VALUE; SODIUM COMPOUNDS; ADSORPTION; TITANATES

53397 (CNIC-I–004, pp. 52-53) **Selective separation of Pb^{2+} ion on cation-exchange resin.** Niu Fang; Ma Taotao; Sun Xiuhua. China Nuclear Information Centre, Beijing, BJ (China); Academia Sinica, Lanzhou, GS (China). Inst. of Modern Physics. Jun 1990. In *IMP annual report, 1988 (January-December).* 138p. Order Number DE91606195. Source: NTIS (US Sales Only), PC A07/MF A01; OSTI; INIS.

Published in summary form only. LEAD COMPOUNDS/adsorption; DISTRIBUTION FUNCTIONS; HYDROCHLORIC ACID; ADSORPTION; ORGANIC ION EXCHANGERS; PH VALUE; SPECTROPHOTOMETRY; THORIUM COMPOUNDS

53398 (CONF-9008129–) **Topics in nuclear and radiochemistry for college curricula and high school science programs.** American Chemical Society, Washington, DC (USA). Div. of Nuclear Chemistry and Technology; National Research Council, Washington, DC (USA). Committee on Nuclear and Radiochemistry. [1990]. 120p. Sponsored by U.S. DOE Energy Research. DOE Contract FG05-89ER75464. From 11. biennial conference on chemical education; Atlanta, GA (USA); 5-9 Aug 1990. Order Number DE91000889. Source: NTIS, PC A07/MF A01; OSTI; INIS; GPO Dep.

The concern with the current status and trends of nuclear chemistry and radiochemistry education in academic institutions was addressed in a recent workshop. The 1988 workshop considered the important contributions that scientist with nuclear and radiochemistry backgrounds have made and are continuing to make to other sciences and to various applied fields. Among the areas

discussed were environmental studies, life sciences, materials science, separation technology, hot atom chemistry, cosmochemistry, and the rapidly growing field of nuclear medicine. It is intent of the organizer and participants of this symposium entitled "Topics in Nuclear and Radiochemistry for College Curricula and High School Science Program" to provide lecture material on topics related to nuclear and radiochemistry to educators. It is our hope that teachers, who may or may not be familiar with the field, will find this collections of articles useful and incorporate some of them into their lectures.

53399 (IPEN-PUB-295) **Preparation of ^{99m}Tc - dextran-500 for use in lymphoscintigraphy.** Hamada, E.S.; Muramoto, E.; Pereira, N.P.S. de; Brito, R.H.; Silva, C.P.G. da. Instituto de Pesquisas Energeticas e Nucleares (IPEN), Sao Paulo, SP (Brazil). Mar 1990. 20p. (In Portuguese). Order Number DE91605594. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

This paper reported the preparation of lyophilized kit Dextran-500 for labelling with ^{99m}Tc used in Nuclear Medicine as a lymphoscintigraphic agent. Each vial contains 100 mg Dextran-500 and 1,5 mg stannous chloride. The radiopharmaceutical was checked by ITLC, and the radiochemical purity and stability were determined. The studies of biological distribution were made in Wistar rats and the clinical evaluation in men was realized. Our results permited to incorporate Dextran-500 formulation as an ideal agent for routine use in lymphoscintigraphic. (author).

53400 **The core-quasiparticle model for odd-odd nuclei and applications to candidates for gamma-ray lasers.** Strottman, D.D. (Theoretical Div., Los Alamos National Lab., Los Alamos, NM (US)). pp. 102 of Short and ultrashort wavelength lasers. Jones, C.R. Society of Photo-Optical Instrumentation Engineers, Bellingham, WA (USA) (1988). pp. 193 (CONF-8801144--: Short and ultrashort wavelength lasers meeting, Los Angeles, CA (USA), 14-15 Jan 1988).

A reliable estimate of the properties of isomers that may be viable candidates for a gamma-ray laser requires the use of the most accurate save functions possible. The majority of models that have been used to estimate the properties of isomers are applicable to only selected regions of the nuclear mass table. In particular, the Bohr-Mottelson model of odd-A and odd-odd nuclei will fail if the even-even core is not strongly deformed or if the deformations are changing strongly as a function of mass. This paper reports how the problem is overcome in a new core- quasiparticle model for odd-odd nuclei. The model introduces the pairing interaction ab initio; the odd-A states are mixtures of particle and hole states. The core may be soft towards deformation or axial asymmetry and may change rapidly as a function of mass. Thus, the model is ideally suited for application to the region of transitional nuclei such as the Te, La, and Os regions.

53401 **Evaluation of sorbent materials.** Rankin, W.N. (Savannah River Lab., Aiken, SC (USA)); Gomillion, S.L.; Luckenbach, R.L. pp. 609-613 of Waste processing, transportation, storage and disposal, technical programs and public education: Volume 2. Low-level waste. Post, R.G. Arizona Board of Regents, Tucson, AZ (USA) (1989). pp. 844 (CONF-890207--: Waste management '89: 15th international waste management symposium conference, Tucson, AZ (USA), 26 Feb - 2 mar 1989).

This paper reports the sorption efficiency of different types of liquid sorbent materials determined under controlled laboratory conditions. Results show that the sorption capacity is affected both by the type of material and by the form of the material. Attractive alternate sorbents to atomic wipes and Oil-Dry were identified. Small pillows of shredded synthetic sorbents are an attractive alternative to Oil-Dry as a sorbent and to atomic wipes as both a sorbent and in decontamination by wiping. Synthetic sorbents in cloth form offer an attractive alternative to atomic wipes in decontamination by wiping because these materials are compatible with nitric acid and they may be more fire resistant. A larger-scale evaluation is planned with the most promising sorbents. In addition, development is planned of a sorbent that will be efficient, compatible with nitric acid, and fire resistant.

4008 Combustion, Pyrolysis, and High-Temperature Chemistry

Refer also to citation(s) 52757

53402 (DOE/ER/13822--T1) **Topics in physico-chemical hydrodynamics: Progress report, 1988--1989.** Sivashinsky, G. City Coll. of New York, NY (USA). Levich Inst. for Physicochemical Hydrodynamics. [1989]. 7p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-88ER13822. Order Number DE91001674. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

This paper discusses the following topics: theory of turbulent flame speed; flame extinction by periodic flow-field; influence of swirl on the structure and extinction of premixed flames; propagation and extinction of nonsteady spherical flame fronts; geometrically invariant formulation of intrinsic dynamics of premixed flames; nonlinear dynamics of oscillatory regime of premixed combustion; and pattern formation in premixed flames. (LSP)

53403 (DOE/ER/13866--1) **Quenching-independent measurement of species concentrations in flames by laser-induced fluorescence: Final report, January 1, 1988--December 31, 1989.** Salmon, J.T.; Carter, C.D.; Laurendeau, N.M. Purdue Univ., Lafayette, IN (USA). Flame Diagnostics Lab. Sep 1990. 29p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-88ER13866. Order Number DE91000795. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This report describes work accomplished in the last two years on measurement of species concentrations in flames via laser-induced fluorescence. During this period, we have published absolute number densities of atomic hydrogen in subatmospheric, premixed $C_2H_4/O_2/Ar$ flames at equivalence ratios of 1.0 and 1.7 via two-photon excited fluorescence. This work has led to the development of a new single-laser, two-step fluorescence method for the detection of atomic hydrogen in flames. Using photoionization controlled-loss spectroscopy (PICLS), we have verified the $T^{-1/2}$ dependence of quenching on temperature for atomic hydrogen, in agreement with kinetic theory. Previous work on pyrometry using laser-saturated fluorescence (LSF) and the anomalous fluorescence from pyrene has evolved into publication of a major review paper on temperature measurements by light-scattering methods. Finally, we have demonstrated the feasibility of quantitative LSF measurements of NO concentration by obtaining relative saturation curves and NO fluorescence profiles. 25 refs.

42 ENGINEERING

4202 Facilities, Equipment, and Techniques

Refer also to citation(s) 52782, 52783, 52784, 53230, 53531, 53789, 53924

53404 (AEEW-M-2592) **Bolt modelling in DYNA3D.** Butler, N.; Neilson, A.J. UKAEA Atomic Energy Establishment, Winfrith (UK). Safety and Engineering Science Div. Aug 1989. 15p. (CONF-890009--: 3. DYNA3D user group conference, London (UK),). Source: Available from H.M. Stationery Office, London, price Pound 8.00.

The paper discusses modelling of bolted closures using DYNA3D, with particular reference to a steel container undergoing severe impact on the lid. Details of bolt thread, section shape and mesh refinement are all considered. A failure criterion is proposed and shown to agree well with test results. Small modifications to an existing material model are found to be necessary to simulate the consequences of bolt failure. (author).

53405 (BNL-45179) **Chaotic transients and fractal structures governing coupled swing dynamics.** Ueda, Y. (Kyoto Univ. (Japan)); Enomoto, T.; Stewart, H.B. Brookhaven National Lab., Upton, NY (USA). [1990]. 18p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. (CONF-901246--1: EPRI workshop on applications of chaos, San Francisco, CA (USA), Dec 1990). Order Number DE91001122. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Numerical simulations are used to study coupled swing equations modeling the dynamics of two electric generators connected to an infinite bus by a simple transmission network. In particular, the effect of varying parameters corresponding to the input power supplied to each generator is studied. In addition to stable steady operating conditions, which should correspond to synchronized, normal operation, the coupled swing model has other stable states of large amplitude oscillations which, if realized, would represent non-synchronized motions: the phase space boundary separating their basins of attraction is fractal, corresponding to chaotic transient motions. These fractal structures in phase space and the associated fractal structures in parameter space will be of primary concern to engineers in predicting system behavior.

53406 (CDTN–ASPC.CN-001/89, pp. 133-148) **Annual report of the components testing program - 1988.** Paiva, I.P.V. Centro de Desenvolvimento da Tecnologia Nuclear (CDTN), Belo Horizonte, MG (Brazil). 1989. (In Portuguese). In *Semi-annual report of Nuclear Technology and Development Center (CDTN) - July to December 1988.* 353p. Order Number DE91606188. Source: NTIS (US Sales Only), PC A16/MF A01; OSTI; INIS.

The main activities developed during the year of 1988 are described. (E.G.).

53407 (CONF-901029–1) **Performance comparison of magnetic refrigeration cycles.** Chen, F.C.; Chen, G.L.; Murphy, R.W.; Mei, V.C. Oak Ridge National Lab., TN (USA). [1990]. 22p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC05-84OR21400. From 6. international cryocooler conference; Plymouth, MA (USA); 25-26 Oct 1990. Order Number DE91001520. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Magnetic refrigeration has been used for cryogenic cooling at temperatures near absolute zero for many years. In these cases, a single-step adiabatic demagnetization method that does not provide continuous refrigeration is commonly used. The possibilities of providing continuous cooling through magnetic refrigeration cycles and of extending the range of applications above near-absolute-zero temperatures have been investigated only in recent years. This paper reports the results of a parametric performance study of three magnetic refrigeration cycles using four rare-earth magnetic materials operating near their respective Curie temperatures. The thermodynamic cycles employed are the magnetic-equivalent Carnot, Ericsson, and ideal regenerative cycles, and the four magnetic materials are terbium, holmium, erbium, and thulium. Our findings show that the Carnot cycle is not possible for cases of temperature lift beyond 10 K for a magnetic field variation of Tesla, that the performance and capacity of an ideal regenerative cycle are higher than that of the corresponding Ericsson cycle, and that the magnetocaloric effects of erbium and thulium seem to be too weak for practical applications. 14 refs., 14 figs.

53408 (EUR–12563) **Study of large size fiber reinforced cement containers for solid wastes from dismantling.** Jaouen, C. (Societe Generale pour les Techniques Nouvelles (S.G.N.), 78 - Saint-Quentin-en-Yvelines (FR)). Commission of the European Communities, Luxembourg (Luxembourg). 1990. 26p. (In French). Contract FI1D-0046. Source: NTIS (US Sales Only), PC A03/MF A01.

The production of large-sized metallic waste by dismantling operations, and the evolution of the specifications of the waste to be stored in the different European countries will create a need for large standard containers for the transport and final disposal of the corresponding waste. The research conducted during the 1984-1988 programme, supported by the Commission of European Communities, and based on a comparative study of high-grade concrete materials, reinforced with organic or metallic fibres, led to the development of a high performance container meeting international transport recommendations as well as French requirements for shallow-ground disposal. The material selected, consisting of high-performance mortar with metal fibre reinforcement, was the subject of an intensive programme of characterization tests conducted in close cooperation with LAFARGE Company, demonstrating the achievement of mechanical and physical properties comfortably above the regulatory requirements. The construction of an industrial prototype and the subsequent economic analysis served to guarantee the industrial feasibility and cost of this system, in which attempts were made to optimize the finished package product, including its closure system.

53409 (EUR–12604) **Expanding to teleoperation of a tight modular workshop for dismantling radioactive components.** Gasc, B. (Societe Technique pour l'Energie Atomique (Technicatome), Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (FR)). Commission of the European Communities, Luxembourg (Luxembourg). 1990. 45p. (In French). Contract no FI1D-0041. Source: NTIS (US Sales Only), PC A03/MF A01.

The CEA (French Nuclear Energy Commission) in connection with TECHNICATOME developed a tight modular workshop for the dismantling of AT1 plant facilities in LA HAGUE. This workshop constructed of reusable stainless steel panels assembled by bolting provides a tight and decontaminable working zone compatible with any building configuration. This being the case, the operators bearing ventilated suits may work under the best safety conditions on alpha-contaminated materials. For the purpose of expanding the working capacities of this workshop it was decided to develop special components for teleoperation from the outside as in a conventional cell. To meet this objective which is within the scope of the contract signed with the CEC, the following components were developed and constructed: - manipulator holder panel, - swivelling hatch panel, - wall equipment sealed transfer device and, - modular biological protection. The design, construction and tests of these new components led to their qualification and further incorporation in the list of components of the modular workshop liable to be used for teleoperation procedures.

53410 (ORNL/Sub–89-SD841/3) **Requirements for canisters used for delivery of spent nuclear fuel and associated materials to DOE [Department of Energy] under standard disposal contracts.** Oak Ridge National Lab., TN (USA); Johnson (E.R.) Associates, Inc., Oakton, VA (USA). Jun 1990. 11p. Sponsored by U.S. DOE Nuclear Energy; U.S. DOE Radioactive Waste Management. DOE Contract AC05-84OR21400. (JAI–340). Order Number DE91000520. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

The Department of Energy (DOE) is studying prospective changes to the waste acceptance criteria contained in the Standard Contract which involve consideration of the possible acceptance of failed fuel, consolidated fuel rods, compacted structural parts resulting from at reactor consolidation operations, and other non-fuel bearing materials on the same scheduling basis as used for standard fuel under the existing Standard Contract. During the course of these studies it has become clear that all such forms of spent fuel and related wastes would have to be delivered to DOE (and stored at the reactor) in a container having an envelope about the same as the fuel assemblies from which the fuel forms originated. Thus, the first objective of the DOE effort has been to develop draft requirements for canisters to be used by utilities (and others) to deliver the foregoing forms of spent fuel and related wastes. These draft requirements have been completed and are included in this paper.

53411 (SAND–89-1493C) **The systems approach to airport security: The FAA [Federal Aviation Administration]/BWI [Baltimore-Washington International] Airport demonstration project.** Caskey, D.L.; Olascoaga, M.T. Sandia National Labs., Albuquerque, NM (USA). [1990]. 11p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-901092–4: Carnahan conference on security technology, Lexington, KY (USA), 10 Oct 1990). Order Number DE91000766. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Sandia National Laboratories has been involved in designing, installing and evaluating security systems for various applications during the past 15 years. A systems approach to security that evolved from this experience was applied to aviation security for the Federal Aviation Administration. A general systems study of aviation security in the United States was concluded in 1987. One result of the study was a recommendation that an enhanced security system concept designed to meet specified objectives be demonstrated at an operational airport. Baltimore-Washington International Airport was selected as the site for the demonstration project which began in 1988 and will be completed in 1992. This

article introduced the systems approach to airport security and discussed its application at Baltimore-Washington International Airport. Examples of design features that could be included in an enhanced security concept also were presented, including details of the proposed Ramps Area Intrusion Detection System (RAIDS).

53412 (SAND–89-2511) **Swing-free movement of simply suspended objects employing parameter estimation.** Werner, J.C.; Robinett, R.D.; Petterson, B.J. Sandia National Labs., Albuquerque, NM (USA). Jun 1990. 11p. Sponsored by U.S. DOE Energy Research. DOE Contract AC04-76DP00789. Order Number DE91000479. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

An adaptive, swing-free trajectory planner for a gantry robot has been analytically developed and experimentally implemented on a commercial robot. A batch, nonlinear least square estimator (differential correction) is used to predict the initial conditions, mass, and frequency of the simply suspended object from a set of force sensor measurements. These parameters, in turn, are supplied to the swing-free trajectory planner to perform the maneuver. These algorithms have been implemented on a CIMCORP XR6100 gantry robot, and swing-free trajectories have been performed by the robot using the adaptive trajectory planner. 8 refs., 4 figs., 1 tab.

53413 (SAND–90-1962) **Standards Laboratory environments.** Braudaway, D.W. Sandia National Labs., Albuquerque, NM (USA). Sep 1990. 9p. Sponsored by U.S. DOE Office of Administration and Human Resource Management. DOE Contract AC04-76DP00789. Order Number DE91000459. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Standards Laboratory environments need to be carefully selected to meet the specific mission of each laboratory. The mission of the laboratory depends on the specific work supported, the measurement disciplines required and the level of uncertainty required in the measurements. This document reproduces the contents of the Sandia National Laboratories Primary Standards Laboratory Memorandum Number 3B (PSLM-3B) which was issued on May 16, 1988, under the auspices of the Department of Energy, Albuquerque Operations Office, to guide the laboratories of the Nuclear Weapons Complex in selecting suitable environments. Because of both general interest and specific interest in Standards Laboratory environments this document is being issued in a more available form. The purpose of this document is to provide guidance in selection of laboratory environments suitable for standards maintenance and calibration operations. It is not intended to mandate a specific environment for a specific calibration but to direct selection of the environment and to offer suggestions on how to extend precision in an existing and/or achievable (practical) environment. Although this documents pertains specifically to standards laboratories, it can be applied to any laboratory requiring environmental control.

53414 (WINCO–1080) **Improved plug valve computer-aided design of plug element.** Wordin, J.J. Westinghouse Idaho Nuclear Co., Inc., Idaho Falls, ID (USA). Feb 1990. 36p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC07-84ID12435. Order Number DE91001044. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The purpose of this document is to present derivations of equations for the design of a plug valve and to present a computer program which performs the design calculations based on the derivations. The valve is based on a plug formed from a tractrix of revolution called a pseudosphere. It is of interest to be able to calculate various parameters for the plug for design purposes. For example, the surface area, volume, and center of gravity are important to determine friction and wear of the valve. A computer program in BASIC has been written to perform the design calculations. The appendix contains a computer program listing and verifications of results using approximation methods. A sample run is included along with necessary computer commands to run the program. 1 fig.

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Refer also to citation(s) 52757, 52891, 53471, 53476, 53477, 53478, 53585, 53960, 53968

53415 (CEA-N–2637) **Study of the Riemann problem and construction of multidimensional Godunov-type schemes for two-phase flow models.** Toumi, I. CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. d'Etudes Mecaniques et Thermiques; Paris-6 Univ., 75 (France). Apr 1990. 364p. (In French). Order Number DE91716294. Source: NTIS (US Sales Only), PC A16/MF A01.

This thesis is devoted to the study of the Riemann problem and the construction of Godunov type numerical schemes for one or two dimensional two-phase flow models. In the first part, we study the Riemann problem for the well-known Drift-Flux, model which has been widely used for the analysis of thermal hydraulics transients. Then we use this study to construct approximate Riemann solvers and we describe the corresponding Godunov type schemes for simplified equation of state. For computation of complex two-phase flows, a weak formulation of Roe's approximate Riemann solver, which gives a method to construct a Roe-averaged jacobian matrix with a general equation of state, is proposed. For two-dimensional flows, the developed methods are based upon an approximate solver for a two-dimensional Riemann problem, according to Harten-Lax-Van Leer principles. The numerical results for standard test problems show the good behaviour of these numerical schemes for a wide range of flow conditions.

53416 (CEA-R–5490) **Deformation of two droplets in a quasi steady-state Stokes flow.** Coutris, N. (Paris-6 Univ., 75 (FR)); Nakach, R. CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France). Inst. de Recherche Technologique et de Developpement Industriel (IRDI). Mar 1990. 75p. (In French). Order Number DE91716295. Source: NTIS (US Sales Only), PC A04/MF A01.

The motion of two droplets or bubbles along their line of centers is considered. The velocities are supposed sufficiently small so that the equations governing these motions are the quasisteady Stokes equations. The shape of the deformed droplets or bubbles is determined by an iterative method for nearly spherical droplets or bubbles. The method is applicable to the motion of a droplet or bubble toward a plane, motionless interface.

53417 (EPRI-NP–6968-D) **Self-compensating flow distribution: Final report.** Desai, P.V. (Georgia Inst. of Tech., Atlanta, GA (USA). School of Mechanical Engineering). Electric Power Research Inst., Palo Alto, CA (USA); Georgia Inst. of Tech., Atlanta, GA (USA). School of Mechanical Engineering. ©Sep 1990. 27p. Sponsored by Electric Power Research Institute. Source: Research Reports Center, Box 50490, Palo Alto, CA 94303.

This report summarizes the analysis and results of experiments conducted to examine the feasibility of incorporating a contoured orifice in a flow line as a self compensating flow distribution device. The anticipated behavior of internal flow through an orifice with a cylindrical profile to display some features of external cross flow over a cylinder forms the focus of the study. The transition from a laminar to a turbulent boundary layer in response to an increase in the upstream Reynolds number causes the separation point to move downstream along the surface of the cylinder. The subsequent effect of a decreased pressure drop across the orifice permits a larger flow rate to pass through the line containing the orifice and a corresponding decrease in the flow rate through a parallel line not containing the orifice. Such a transition phenomenon is borne out by the experiments which identify the range of flow rates within which it occurs. Potential advantages of incorporating such a device as a retrofit to existing power generation of processing industries, as well as a design modification for power reactors of the twenty-first century, are pointed out. 24 refs., 13 figs.

53418 (LNCC–007/90) **Elastic-plastic potential functionals for rates and increments of stress and strain.** Feijoo, R.A. (Laboratorio Nacional de Computacao Cientifica (LCC), Rio de Janeiro, RJ (Brazil)); Zouain, N. Laboratorio Nacional de Computacao Cientifica (LNCC), Rio de Janeiro, RJ (Brazil). Mar 1990. 25p. Order Number DE91605931. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

In this work attention is focused in the derivation of variational formulations of the constutive relationship in the form of conjugate potential functionals from which stress and strain rates are derived as elements of the corresponding sub-differential sets. The main result obtained is a pair of potential functionals. (A.C.A.S.).

53419 (LNCC–026/89) **The combined Petrov-Galerkin method with auto-adapting schemes and its applications in numerical resolution of problems with limit layer.** Silva, R.S. (Laboratorio Nacional de Computacao Cientifica (LCC), Rio de Janeiro, RJ (Brazil)); Galeao, A.C.; Carmo, E.G.D. do. Laboratorio Nacional de Computacao Cientifica (LNCC), Rio de Janeiro, RJ (Brazil). Jul 1989. 17p. (In Portuguese). Order Number DE91605932. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

In this paper a new finite element model is constructed combining an r- refinement scheme with the CCAU method. The new formulation gives better approximation for boundary and internal layers compared to the standard CCAU, without increasing computer codes. (author).

53420 (LNCC–030/89) **Simulation of unilateral contact problems departing from the classical boundary problems.** Frey, S.L. (Pontificia Univ. Catolica do Rio de Janeiro, RJ (Brazil). Dept. de Engenharia Mecanica); Sampaio, R.; Gama, R.M.S. da. Laboratorio Nacional de Computacao Cientifica (LNCC), Rio de Janeiro, RJ (Brazil). Aug 1989. 15p. (In Portuguese). Order Number DE91605933. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

A numerical algorithm is proposed for simulating unilateral contact problems under the classical elasticity point of view. This simple algorithm may be employed by engineers with a minimum knowledge on classical elasticity. (A.C.A.S.).

53421 (LNCC–034/89) **Adaptative mixed methods to axisymmetric shells.** Malta, S.M.C.; Loula, A.F.D.; Garcia, E.L.M. Laboratorio Nacional de Computacao Cientifica (LNCC), Rio de Janeiro, RJ (Brazil). Sep 1989. 16p. (In Portuguese). Order Number DE91605934. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

The mixed Petrov-Galerkin method is applied to axisymmetric shells with uniform and non uniform meshes. Numerical experiments with a cylindrical shell showed a significant improvement in convergence and accuracy with adaptive meshes. (A.C.A.S.).

53422 (LNCC–037/89) **Petrov-Galerkin mixed formulations for bidimensional elasticity.** Toledo, E.M.; Loula, A.F.D.; Guerreiro, J.N.C. Laboratorio Nacional de Computacao Cientifica (LNCC), Rio de Janeiro, RJ (Brazil). Oct 1989. 19p. (In Portuguese). Order Number DE91605935. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

A new formulation for two-dimensional elasticity in stress and displacements is presented. Consistently adding to the Galerkin classical formulation residuals forms of constitutive and equilibrium equations, the original saddle point is transformed into a minimization problem without any restrictions. We also propose a stress post processing technique using both equilibrium and constitutive equations. Numerical analysis error estimates and numerical results are presented confirming the predicted rates of convergence. (A.C.A.S.).

53423 (LNCC–042/89) **Analysis of stationary fluence by minimization of a functional in tension and velocity.** Loula, A.F.D.; Guerreiro, J.N.C.; Toledo, E.M. Laboratorio Nacional de Computacao Cientifica (LNCC), Rio de Janeiro, RJ (Brazil). Nov 1989. 16p. (In Portuguese). Order Number DE91605936. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

New mixed finite element formulations for plane elasticity problems are presented with no limitation in the choice of conforming finite element spaces. Adding least square residual form of the governing equations to the classical Galerkin formulation the original saddle point problem is transformed into a minimization problem. Stability analysis, error estimates and numerical results are presented, confirming the error estimates and the good performance of this new formulation. (author).

53424 (LNCC–045/89) **Application of the finite volume method in the simulation of saturated flows of binary mixtures.** Murad, M.A. (Laboratorio Nacional de Computacao Cientifica (LCC), Rio de Janeiro, RJ (Brazil)); Gama, R.M.S. da; Sampaio, R. Laboratorio Nacional de Computacao Cientifica (LNCC), Rio de Janeiro, RJ (Brazil). Dec 1989. 26p. Order Number DE91605937. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

This work presents the simulation of saturated flows of an incompressible Newtonian fluid through a rigid, homogeneous and isotropic porous medium. The employed mathematical model is derived from the Continuum Theory of Mixtures and generalizes the classical one which is based on Darcy's Law form of the momentum equation. In this approach fluid and porous matrix are regarded as continuous constituents of a binary mixture. The finite volume method is employed in the simulation. (author).

53425 (SAND–90-8486) **Compressible flow of a multiphase fluid between two vessels: Part 1, Ideal carrier gas.** Chenoweth, D.R. (Sandia National Labs., Livermore, CA (USA)); Paolucci, S. Sandia National Labs., Livermore, CA (USA). Jun 1990. 47p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DR00789. Order Number DE91000490. Source: NTIS, PC A04/MF A01 - OSTI; GPO Dep.

The transfer of a multiphase fluid from a high pressure vessel to one initially at lower pressure is investigated. The fluid is composed of two phases which do not undergo any change. The phases consist of an ideal gas, and solid particles (or liquid droplets) having constant density. The mixture is assumed to be stagnant and always perfectly mixed as well as at thermal equilibrium in each constant volume vessel. The fluid also remains homogeneous and at equilibrium while flowing between vessels. The transport properties of the mixture are taken to be zero. One important finding is that the expanding mixture or pseduo-fluid behaves similar to a polytropic Abel-Noble gas. The mixture thermodymanic properties, the end state in each vessel at pressure equilibrium, the critical parameters, and time dependent results are given for the adiabatic and isothermal limiting cases. The results include both initially sonic and initially subsonic transfer. No mathematical restriction is placed on the particle concentration, although some limiting results are given for small particle volume fraction. The mass transferred at adiabatic pressure equilibrium can be significantly less than that when thermal equilibrium is also reached. Furthermore, the adiabatic pressure equilibrium level may not be the same as that obtained at thermal equilibrium, even when all initial temperatures are the same. Finally, it is shown that the transfer times can be very slow compared to those of a pure gas due to the large reduction possible in the mixture sound speed. 18 refs.

53426 (WSRC-MS–90-158) **The effect of longitudinal spacer ribs on the minimum pressure drop in a heated annulus.** Johnston, B.S.; Neff, J.M. Westinghouse Savannah River Co., Aiken, SC (USA). [1990]. 19p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC09-89SR18035. (CONF-901194–4: ASME winter annual meeting, Dallas, TX (USA), 25-30 Nov 1990). Order Number DE91000784. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

When evaluating a heated flow passage for vulnerability to static flow excursions, special note should be taken of flow restrictions which might allow premature vapor generation. In this study, measurements of steady state pressure drop were made for the downward flow of water in a vertical annulus. The outer wall was uniformly heated to allow subcooled boiling. Minima in the pressure drop characteristics were compared for test sections with and without longitudinal spacer ribs. For a given power and inlet temperature, the minimum occurred at a higher flow rate in the ribbed test section. This is attributed to vapor generation at the ribs. The work cited in this document show how a restriction in a heated channel can produce vapor which would not be observed in the absence of the restriction. In the present study, the effect of a flow restriction on the tendency to flow excursion is explored by finding demand curves for a heated annulus in subcooled boiling flow. The annulus is heated from the outside, and alternately equipped with and without longitudinal spacer ribs. These ribs separate the heated and unheated walls; in pressing against the heated wall they provide a means for premature vapor production.

53427 **Non-optimal entropy generation by heat transfer in cryogenic domain.** Sekulic, D.P. (Novi Sad Univ. (Yugoslavia). Dept. of Mechanical Engineering); Edeskuty, F.J. pp. 339-346 of A future for energy. Flowers '90. Proceedings of the Florence world energy research symposium. Florence, 28 May-1 June 1990.

Stecco, S.S. (ed.); Moran, M.J. (ed.). Pergamon Press, Oxford, U.K. (1990). pp. 941 (CONF-900508--: FLOWERS '90: Florence world energy research symposium, Florence (Italy), 28 May - 1 jun 1990).

In this analysis of entropy generation caused by heat conduction for physical situations related to cryostats, the situations under consideration were characterized by heat conduction with the presence or absence of heat generation and/or heat convection. The existing information regarding the thermodynamic optimal design was compared with more realistic non-optimal situations. The difference between the optimal and non-optimal entropy generation was analyzed from the quantitative point of view. It was shown that the non-optimal temperature distribution through a cryostat component might be a realistic option from the thermal design point of view.

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Refer also to citation(s) 52961, 52986, 52999, 53224, 53242, 53313, 53959, 54168

53428 (EPRI-NP–7007) **Operation of the EPRI Nondestructive Evaluation Center: 1989 annual report: Final report.** Stone, R.M. (Jones (J.A.) Applied Research Co., Charlotte, NC (USA)); Ammirato, F.V.; Becker, F.L.; Jeong, Y.H.; Krzywosz, K.J.; MacDonald, D.E.; Nottingham, L.D.; Selby, G.P.; Shankar, R.; Stephens, H.M.; Stramm, J.N.; Walker, S.M.; Willetts, A.J. Electric Power Research Inst., Palo Alto, CA (USA); Jones (J.A.) Applied Research Co., Charlotte, NC (USA). ©Sep 1990. 175p. Sponsored by Electric Power Research Institute. Source: Research Reports Center, Box 50490, Palo Alto, CA 94303.

This report describes the Electric Power Research Institute (EPRI) funded nondestructive evaluation (NDE) and life assessment project activities carried out at the EPRI NDE Center in 1989. The primary support for this program is provided through contract RP 1570-2 with the EPRI Nuclear Division. Supplementary funding is provided by other contracts with the EPRI Nuclear and Generation and Storage Divisions. The major objective of this program is to provide improved and field-qualified NDE equipment, procedures, and personnel training to the electric utility industry. A second program objective involves the validation, provision, and maintenance of life assessment codes for selected plant components. Significant assistance has been provided to the utility industry under this project in the form of improved, field-theory equipment and procedures; critically needed assessments of inspection method capability; demonstrations of effectiveness of examination methods; rapid response for critical, short-term problems; assistance with selected life assessment computer codes; and training for specific utility industry needs. These efforts have specifically involved heat exchanger, piping, steam turbine, generator, and heavy section problems. Certain components of both nuclear and fossil plants have been addressed.

53429 (EUR–12430) **PISC II: parametric studies the purpose of the PISC II parametric studies programme.** Crutzen, S. (Commission of the European Communities, Ispra (IT). Joint Research Centre). Commission of the European Communities, Luxembourg (Luxembourg). Sep 1989. 14p. Source: NTIS (US Sales Only), PC A03/MF A01.

The results of the PISC I round robin test of the ASME type procedure showed a very large dispersion. The amplitude of response of all defects varied very much among the teams from the 27 laboratories considered for the evaluation of results. Scatter on detection and sizing in PISC I was such that discussions started on the reasons for such a phenomenon when exactly the same procedure was used by all teams. The observation of two teams' results (JRC Ispra and ENEL Piacenza, Italy) induced the NDE Ispra laboratories to insist on the possible importance of equipment characteristics. All PISC members insisted on specific studies of the influence of defect characteristics as well as the role of cladding. These three chapters were the leading PIS laboratory exercises called Parametric Studies.

53430 (EUR–12431) **PISC II: Parametric studies flaw characterisation using the TANDEM and TOFD techniques.** Murgatroyd, R.A. (UKAEA Northern Research Labs. Risley (UK)); Highmore, P.J.; Bann, T.; Burch, S.F.; Ramsey, A.T. Commission of the European Communities, Luxembourg (Luxembourg). Sep 1989. 37p. Contract No. 2871-85-12 EN ISP - GB. Source: NTIS (US Sales Only), PC A03/MF A01.

Studies on the effect of flaw characteristics and selected inspection parameters on the detection and sizing of flaws in ferritic steel blocks have been performed by the United Kingdom Atomic Energy Authority (UKAEA) as part of a larger Commission of the European Communities (CEC) Parametric Study programme. The techniques included in the UKAEA studies were the 45^0 tandem and the time-of-flight diffraction (TOFD) techniques. The purpose of the work was to acquire reliable experimental data that could be used both to test and verify theoretical models and to contribute to the resolution of anomalies encountered in PISC round-robin inspection exercises. To this end, the data were gathered in a format compatible with that of the theoretical predictions and scanning parameters were employed that would test the theoretical models over a range of inspection conditions. For the studies, eighteen test blocks were fabricated by Ispra in which a range of flaw types were inserted covering flaw shape, size, roughness and orientation. Thirteen of these were selected for the UKAEA programme on the basis of their relevance to the validation of theoretical models and their value to flaw characterisation studies. The work involved in the programme was shared between Risley Nuclear Laboratories (RNL) and AERE Harwell, with the teams inspecting two similar procedures. The first series of test blocks and probes for use with the tandem technique was received in June 1986 and commissioning of scanning and data gathering equipment commenced. This part of the programme was completed early in 1987. Two test plates suitable for use with the TOFD technique were received in May 1987 and the experimental scanning received high priority in the UKAEA to enable the plates to be despatched to Association Vincotte at the end of May 1987. This final report describes the programme, data gathering procedures and the results of the studies.

53431 (EUR–12433) **PISC II: Parametric studies effect of defect characteristics on immersion focusing probe testing results.** Dombret, P. Commission of the European Communities, Luxembourg (Luxembourg). Sep 1989. 23p. Contract No. 2860-85-12 EN ISP - B. Source: NTIS (US Sales Only), PC A03/MF A01.

The results of the Round-Robin trials conducted under the PISC I exercise (1976-1980) showed large discrepancies in the defect detection and sizing capability among different flaws. To identify the causes of such dispersions and quantify the effects, a Parametric Study was included in the PISC II project, taking into consideration most characteristics of planar flaws. A number of steel specimens containing various artificial defects was made available for the measurements. The defects were ultrasonically scanned by standard methods and by some advanced techniques the high performance of which had been established in the PISC Round-Robin Tests. This report deals with the beam focusing technique: 2 MHz 45^0 shear wave transducers have been used in immersion to collect the signals generated by the reference reflectors. The results show that the depth and the size of a defect do not affect significantly its detection and sizing, provided that the natural variation of sensitivity and of beam diameter along the propagation axis is taken into account. On the other hand, parameters such as the orientation and the roughness modify the conditions of impact and interference of the acoustic beam with the defect surface, and therefore strongly influence the energy partition in diffracted and specularly reflected rays. As an example, sharp smooth defects insonified under an angle of 45^0 return to the transducer signals approximately 10 times smaller than the ASME code calibration level.

53432 (EUR–12435) **PISC II: Parametric studies Summary of the PISC II Parametric studies on the Effect of defect Characteristics (EDC).** Crutzen, S. (Commission of the European Communities, Ispra (IT). Joint Research Centre); Certo, M.; Murgatroyd, R.; Dombret, P. Commission of the European Communities, Luxembourg (Luxembourg). Sep 1989. 28p. Contracts No. 2861-85-12 EN ISP - I, No. 2860-85-12 EN ISP - B, Source: NTIS (US Sales Only), PC A03/MF A01.

Studies on the effect of defect characteristics and selected inspection parameters on the detection and sizing of defects in ferritic steel blocks have been performed by: - United Kingdom

Atomic Energy Authority (UKAEA, Risley and Harwell), - CISE, (Italy, Milan), - VINCOTTE (Belgium, Brussels), - CEC, JRC (Ispra Site; complementary measurements), as part of a larger Commission of the European Communities (CEC) programme in support to the PISC (Programme for the Inspection of Steel Components), jointly sponsored by OECD (Organization for Economic Coordination and Development) and CEC and operated by the Joint Research Centre (JRC), Ispra Establishment. The purpose of the programme was to acquire reliable experimental data that could be used both to explain results of the PISC I and II Round Robin Tests (RRT) and to test and validate theoretical models of the ultrasonic testing techniques. For these studies, eighteen test blocks were manufactured by JRC Ispra, Operating Agent and Reference Laboratory of PISC. A range of defect types was inserted with great care covering aspects such as defect shape, defect size, defect surface roughness, defect position in depth, defect orientation. Several of these blocks (defects) were selected by the participating institutions. Each of these participants applied well specified usual ultrasonic techniques: echo techniques, tandem technique, focusing probe technique at 45^0 and time of flight diffraction (TOFD). Results of such measurements propose clear correlation between defect characteristics and amplitude of response of these defects.

53433 (UCRL-CR–104838) **Nondestructive evaluation of residual stress in anisotropic materials: Final report.** Johnson, G.C. (California Univ., Berkeley, CA (USA). Dept. of Mechanical Engineering). Lawrence Livermore National Lab., CA (USA); California Univ., Berkeley, CA (USA). Dept. of Mechanical Engineering. May 1990. 21p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. Order Number DE91000952. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The specific focus on anisotropic materials in the research was addressed in a manner which was primarily analytical. All of the experiments involving materials with substantial elastic or plastic anisotropy indicated that the materials in question exhibited a level of acoustoelastic response which was at or below the limit for useful stress evaluation. Nevertheless, the analysis performed indicates that if an experimental system is built which allows determination of the velocity variation roughly an order of magnitude more precisely than is possible with the system used in this work, the complete state of residual stress may be obtained, despite the presence of anisotropy. This report consists of a detailed description of the technique and experimental system proposed for the evaluation of residual stress states. The underlying analytical developments are reviewed, and a numerical investigation into the application of this approach for anisotropic materials is presented. It is shown that an accurate assessment of the complete residual stress state may be obtained even in cases of extreme anisotropy. Finally, an experimental investigation of the technique is presented in which the experimentally determined stress state is compared with that predicted numerically. It is shown that the two estimates of stress agree well for the material involved. 12 refs., 5 figs., 1 tab.

4210 Combustion Systems

Refer also to citation(s) 52694, 52920

53434 (VTT-SYMP–107, pp. 185-208) **Status of fludized bed combustion experiences with circofluid plants in operation.** Tigges, K.D. (Vereinigte Kesselwerke AG, Duesseldorf (Germany, F.R.)). Valtion Teknillinen Tutkimuskeskus, Espoo (Finland). 1989. (CONF-890668–Vol.1: Symposium on low-grade fuels, Helsinki (Finland), 12-16 Jun 1989). In *Low-grade fuels: Volume 1.* 376p. Order Number DE91707607. Source: NTIS (US Sales Only), PC A17/MF A01.

The CIRCOFLUID System represents a further development of the FBC technology and offers the following essential features: Use of a wide range of fuels with simple fuel preparation; high combustion and desulfurisation efficiency due to ash recirculation and low NO_x values as a result of low combustion temperature and multistage combustion; cooled water walls of membrane-type and the cold cyclone allowing short start-up and shutdown periods; load response and boiler turndown equal to conventional steam generators with pulverized coal firing. After a brief introduction of the development and the main features of the CIRCOFLUID System, the capability of the system to burn fuels at high encironmental and economic standards will be demonstrated on the basis of results obtained from an experimental facility and a commercial unit. One of the steam generators equipped with CIRCOFLUID fluidised bed firing is installed in the cogeneration plant Saarbruecken utility, West Germany. This contribution explains the design of the plant, the air/flue gas system, the feeding of coal and recirculation of ash and the ash discharge. Start-up firing and supplementary firing with blast furnace gas are also being dealt with. In addition, experience gathered with the new steam generator are being described, giving also measured values of CO, NO_2 and SO_2, as well as results of the coal burn-out. The contribution is concluded with remarks on experience made with the pertaining plant components on the coal and ash side.

53435 (VTT-SYMP–107, pp. 167-184) **Latest experiences of pyroflow circulating fluidized bed boiler for combustion of low-grade fuels.** Kuivalainen, R. (A. Ahlstrom Corporation, Karhula (Finland). Hans Ahlstrom Laboratory). Valtion Teknillinen Tutkimuskeskus, Espoo (Finland). 1989. (CONF-890668–Vol.1: Symposium on low-grade fuels, Helsinki (Finland), 12-16 Jun 1989). In *Low-grade fuels: Volume 1.* 376p. Order Number DE91707607. Source: NTIS (US Sales Only), PC A17/MF A01.

One of the most attractive advantages of circulating fluidized beds is their capability to burn a wide variety of solid, liquid or gaseous fuels in an environmentally acceptable manner. Ahlstrom Pyroflow Circulating Fluidized Bed Boiler was developed in the late seventies. The first commercial applications were designed to burn peat, wood wastes and coal separately or simultaneously. This has given extremely valuable experience about operation, environmental behaviour and availability of the system in the long term. In the end of the year 1988, there were 65 Pyroflow CFB boilers in operation or under design and construction of which 30 units are primarily designed to burn low grade fuels such as peat, wood wastes, lignites, oil shale, coal rejects, etc., as the only fuel or mixture. The largest Pyroflow units for low grade fuels under contrustion are Kainuun Voima Oy's 240 MW_t unit for firing peat-wood wate-sludge-coal mixture and Vaskiluodon Voima Oy's 300 MW_t unit for firing peat, coal and oil. The units will commence their operation in 1989 and 1990, respectively. This paper presents the latest experiences of the two 80 MW_e Ahlstrom Pyroflow CFB boilers for Gilberton Power Company designed to burn low grade anthracite culm.

4220 Mining and Underground Engineering

Refer also to citation(s) 52883

4230 Marine Engineering

53436 (GKSS–89/E/56) **Adaptation of a robot subsystem for sea-water application and tests down to 1100 m water depth.** Aust, E. (GKSS-Forschungszentrum Geesthacht GmbH, Geesthacht-Tesperhude (Germany, F.R.)); Niemann, H.R.; Schultheiss, G.F.; Markfort, D.; Bruetsch, E.; Schmidt, H. GKSS-Forschungszentrum Geesthacht GmbH, Geesthacht-Tesperhude (Germany, F.R.). 1989. 6p. (In German). Source: Special print from Robotersysteme (1989) v. 5 p. 233-237.

This paper presents a robot subsystem, which has been modified for the operation in sea-water down to 1100 m water depth. The criteria for the selection of the robot are described briefly and essential modifications of the subsystem for this special application are indicated. In addition the experimental results are presented, which have shown the safe function of this subsystem so far tested. (orig.).

53437 (GKSS–89/E/62) **Experiences of Brasil/German NDT-trials at PETROBRAS research platform-PPL-1-TG in 1988.** Manthey, H.J. (GKSS-Forschungszentrum Geesthacht GmbH, Geesthacht-Tesperhude (Germany, F.R.). Inst. fuer Anlagentechnik); Camerini, C.S.; Kelb, W.; Leonard, D. GKSS-Forschungszentrum Geesthacht GmbH, Geesthacht-Tesperhude (Germany, F.R.). 1989. 18p. (CONF-890827–1: 7. international symposium on offshore engineering (Brasil offshore '89), Rio de

Janeiro (Brazil), 21-25 Aug 1989). Order Number DE91712415. Source: NTIS (US Sales Only), PC A03/MF A01.

According to Brasilian-German Bilateral Cooperation in Scientific Research and Technological Development a German group of 7 people (scientists and divers) joint the Petrobras/CENPES members in Nov./Dec. 1988 to explain and demonstrate NDT-methods developed at GKSS and Hannover University together with industrial partners. Three methods were demonstrated dry at CENPES and in water at the research platform-PPL-1TG in Angra dos Reis: A Magnetic Particle Inspection method (MPI) especially for underwater use called MAGFOIL (surface crack detection); an Eddy-Current Inspection system (ECI) (surface crack detection); an Ultrasonic Inspection (USI) with an orientation monitor (ORMON). The underwater tests were done using different samples in a water depth of 12 m and using one node of the test platform in 3 m water depth. Results of the tests and the evaluation are explained in details. (orig.) With 3 figs., 1 tab.

4260 Components, Electron Devices and Circuits

Refer also to citation(s) 53269, 53309, 53310, 53319, 53574, 53580, 53582, 53586, 53589, 53599, 53601, 53952, 53953, 53954, 53955, 53956, 53957, 53960, 53961, 53962, 53963, 53964, 53965, 54227, 54293, 54296, 54326, 54329, 54333, 54442

53438 (AD-A-223961/4/XAB) **Triplet extinction coefficients of some laser dyes. II.** Pavlopoulos, T.G.; Golich, D.J. Naval Ocean Systems Center, San Diego, CA (USA). Jan 1990. 26p. Source: NTIS, PC A03/MF A01.

Pub. in Jnl. of Applied Physics, (Jan 1990).

We measured the triplet extinction coefficients over the laser action spectral region of DODC, DMC, Sulforhodamine B, Rhodamine 575, Coumarin 523, Coumarin 521, Coumarin 504, Coumarin 498, Coumarin 490, LD466, bis-MSB, and BBO. We employed the different lines from an argon and a krypton ion cw laser for excitation. McClure's method was again employed to measure the triplet extinction coefficients. We provide a simplified derivation of McClure's equation. The triplet extinction coefficient of Rhodamine 575 was also measured by using the depletion method and improving it by reconstructing for true triplet-triplet (T-T) absorption. The ET value obtained is in good agreement with the one obtained by McClure's method.

53439 (AD-A-223979/6/XAB) **Tunable C-W single-frequency source for injection seeding 2-micrometer lasers. Final technical report, 1 July-31 December 1988.** Byer, R.L. Stanford Univ., CA (USA). Edward L. Ginzton Lab. Jun 1990. 63p. Contract N00014-88-K-0576. (GL-4697). Source: NTIS, PC A04/MF A01.

This program developed a stable, single-frequency, continuous-wave (CW) optical parametric oscillators (OPOs) for the application of injection seeding pulsed lasers. Progress has been made in the demonstration and performance characterization of doubly resonant optical parametric oscillator (DROs) operating near degeneracy pumped by 532-nm CW radiation obtained from second harmonic generation of diode-array-pumped Nd:YAG lasers. It was observed that the OPO reproduced the coherence of the pump radiation with little additional noise. A detailed analysis of the tuning and control properties of the DRO helpful for development of active stabilization techniques has been completed. Design considerations for a 2-micron DRO based on this analysis are presented. Stabilization of the DRO requires synchronized control of at least three parameters; temperature, pump frequency, and applied potential for electro-optic tuning are considered. Research on this topic is continuing motivated by a the exceptional coherence and tuning properties of the OPO and applications involving optical frequency synthesis that will extend far beyond injection seeding.

53440 (AD-A-224105/7/XAB) **Development of an all solid-state 6-kHz pulse generator for driving free-electron-laser amplifiers. Final technical report, 15 July 1988-14 July 1990.** Birx, D. Science Research Lab., Inc., Somerville, MA (USA). 16 Jul 1990. 191p. Contract N00014-88-C-0398. (SRL-08-F-1990). Source: NTIS, PC A09/MF A01.

Five new, all-solid-state pulse generators have been designed to meet the requirements for an efficient, reliable pulsed power source to drive free electron laser amplifiers. Four of these have been constructed and tested. These SCR-commutated, nonlinear magnetic pulse compressors will be fully-compatible with present high power SDIO induction linac driven free electron laser. By employing SCRs rather than thyratron commutators, these pulsers should provide a significant increase in reliability over the current generation pulsed power drivers proposed as drivers for Free Electron Lasers. SCR-commutated nonlinear magnetic pulse compressors, SNOMAD-I, II, IV and V have been successfully tested at SRL. The goals of this research effort have been realized. A line of cost effective, reliable, efficient, all-solid-state induction linac drivers has now been developed.

53441 (AD-A-224116/4/XAB) **Ion-implanted high-microwave-power indium phosphide transistors.** Nguyen, R. Naval Ocean Systems Center, San Diego, CA (USA). Sep 1989. 7p. Source: NTIS, PC A02/MF A01.

Pub. in IEEE Transactions on Microwave Theory and Techniques, Vol. 37, No. 9, 1321-1326(Sep 1989).

Indium phosphide (InP) metal-insulator-semiconductor field-effect transistors (MISFETs) have demonstrated substantially higher output power density at microwave frequencies compared to gallium arsenide metal-semiconductor field-effect transistors (MESFETs). Presented here are the microwave characteristics from an investigation of encapsulated rapid thermal annealing (RTA) for the fabrication of InP power MISFETs with ion-implanted source, drain, and active channel regions. The MISFETs had a gate length of 1.4 microns. They were made with individual gate finger widths of 100 or 125 microns, and six to ten gate fingers per device were used to make MISFETs with total gate widths of 0.75, 0.8, or 1 mm. The source and drain contact regions and the channel region of the MISFETs were fabricated using silicon implants in semi-insulating InP at energies from 60 to 360 keV with doses from 10 to the 12th power to 5.6 x 10 to the 14th power/sq cm. The implants were activated using RTA at 700 C for 30 s in N2 or H2 ambients using a silicon nitride encapsulant. The channel region was chemically recessed prior to depositing approximately 1000 A of SiO2 for the gate insulator. The high power and high efficiency of InP MISFETs were characterized at 9.7 GHz, and the output microwave power density for the RTA conditions used was as high as 2.4 W/mm. For a 1 W input at 9.7 GHz gains up to 3.7 dB were observed, with an associated power-added efficiency of 29 percent. The output power density achieved was 70 percent greater than has been achieved with GaAs MESFETs.

53442 (AD-A-224120/6/XAB) **III-V semiconductor quantum well lasers and related opto-electronic devices on silicon. Technical report.** Holonyak, N.; Hsieh, K.C.; Stillman, G.E. Illinois Univ., Urbana, IL (USA). Jun 1990. 30p. Contract DAAL03-89-K-0008. Source: NTIS, PC A03/MF A01.

For some time interests have been aroused by the III-V quantum well heterostructures (QWHs) and superlattices (SLs) and, in addition to fundamental effects, the special opportunities QWHs and SLs afford in making possible improved forms of lasers, not to mention other devices and optoelectronic systems. In this report, studies have been made of: (1) Al(x)Ga(1-x)As-GaAs lasers on Si, (2) impurity induced layer disordering (which is an especially advantageous phenomenon in QWHs and SLs), (3) phonon-assisted laser operation and its unambiguous identification by control of the cavity Q of QWH samples, (4) the use of cavity Q to fill the recombination spectrum of QWHs, and (5) hydrolization and reliability of Al(x)Ga(1-x)As-GaAs QWHs and SLs, and (6) various other laser problems associated with higher gap crystals such as In(y)(Al(x)Ga(1-x)(1-y)P).

53443 (AD-A-224219/6/XAB) **Chemical stabilization of laser dyes. Final report, 1 April 1987-31 March 1990.** Koch, T.H. Colorado Univ., Boulder, CO (USA). Dept. of Chemistry. 10 Apr 1990. 9p. Contract DAAL03-87-K-0053. Source: NTIS, PC A02/MF A01.

Irradiation of ethanol solutions of coumarin laser dye lasers produces products which absorb at the lasing wavelength. This results in attenuation of dye laser output through interference of stimulated emission. A major photoprocess which produces material which absorbs at the lasing wavelength is dye sensitized solvent oxidative oligomerization, producing aldehydic and ketonic products. A dye

laser stabilization technique is removal of these carbonyl compounds as they are formed by reduction with a polymer bound borohydride reducing agent.

53444 (AD-A-224264/2/XAB) **VLSI design for reliability. Final report, September-November 1989.** Hajj, I.N.; Najm, F.N.; Yang, P. Illinois Univ., Urbana, IL (USA). Coordinated Science Lab. May 1990. 24p. Contract F30602-88-D-0028. Source: NTIS, PC A03/MF A01.

This report contains the results of supplementary work done related to the reliability analysis of Application Specific Very Large Scale Integrated (ASIC VLSI) CMOS circuits. The major work is currently being carried out under Task N-9-5716. The main goal of both tasks is to determine the electromigration susceptibility of VLSI circuits. Electromigration is a major reliability problem caused by the transport of atoms in a metal line due to the electron flow. Under persistent current stress, electromigration can cause deformations of the metal lines which may result in shorts or open circuits. The failure rate due to electromigration depends on the current density in the metal lines and is usually expressed as a median-time-to-failure (MTF). This work focuses on the electromigration problem in the power and ground busses. To estimate the bust MTF, an estimate of the current waveform in each branch of the bus is required. In general, the MTF is dependent on the shape of the current waveform, and not simply on its time-average. However, a very large number of such waveform shapes are possible, depending on what inputs are applied to the circuit. This is especially true for complementary metal oxide semiconductors circuits, which draw current only during switching.

53445 (AD-A-224379/8/XAB) **Laser physics and laser spectroscopy. Final report, 15 September 1988-14 November 1989.** Byer, R.L. Stanford Univ., CA (USA). Edward L. Ginzton Lab. Apr 1990. 85p. Grant AFOSR-88-0354. Source: NTIS, PC A05/MF A01.

Two essential difficulties must be addressed in any low-power frequency conversion device; boosting the efficiency above that of simple single-pass bulk devices (which are typically less than 1%/W) and achieving phase-matching for the desired interaction. Waveguide interactions were used to increase the conversion efficiency, and explored quais-phase-matching (QPM) as a broadly applicable approach to meeting the phasematching condition. Both oxide ferrelectrics like $LiNbO_3$ and quantum-wells in III-V semiconductors have been investigated for these applications. Second harmonic generation (SHG) of near-infrared lasers to produce green and blue radiation, as well as SHG of the 9-11 micrometer output of a CO_2 laser have been demonstrated in these materials. These media together constitute a significant step towards the goal of generic nonlinear media for the far-infrared - ultraviolet, based on readily available materials and fabricated with standard technologies, applicable to essentially any frequency conversion application.

53446 (BNL-45161) **Proposed UV-FEL user facility at BNL.** Ben-Zvi, I.; Di Mauro, L.F.; Krinsky, S.; White, M.G.; Yu, L.H. Brookhaven National Lab., Upton, NY (USA). [1990]. 15p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. (CONF-9009166-7: 12. international free electron laser conference (FEL-12), Paris (France), 17-21 Sep 1990). Order Number DE91001131. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The NSLS at Brookhaven National Laboratory is proposing the construction of a UV-FEL operating in the wavelength range from visible to 1000Å. Nano-Coulomb electron pulses will be generated at a laser photo-cathode RF gun at a repetition rate of 10 KHz. The 6 ps pulses will be accelerated to 250 MeV in a superconducting linac. The FEL consists of an exponential growth section followed by a tapered section. The amplifier input is a harmonic of a tunable visible laser generated either by nonlinear optical material or the non-linearity of the FEL itself. The FEL output in 10^{-4} bandwidth is 1 mJ per pulse, resulting in an average power of 10 watts. The availability of radiation with these characteristics would open up new opportunities in photochemistry, biology and non linear optics, as discussed in a recent workshop held at BNL. 10 refs., 4 figs., 1 tab.

53447 (CDTN-ASPC.CN-001/89, pp. 257-261) **Semi-annual report of the Electronic Division of CDTN - July to December 1988.** Valente, E.S.; Neto, A.D.; Ferreira, L.M. Centro de Desenvolvimento da Tecnologia Nuclear (CDTN), Belo Horizonte, MG (Brazil). 1989. (In Portuguese). In *Semi-annual report of Nuclear Technology and Development Center (CDTN) - July to December 1988.* 353p. Order Number DE91606188. Source: NTIS (US Sales Only), PC A16/MF A01; OSTI; INIS.

The main activities developed by the Electronic Division of CDTN for constructing and maintenance the equipments are described. (E.G.).

53448 (DOE/ER/13973-3) **Nonlinear dynamics of broadband lasers: Progress report, September 1, 1988-August 31, 1990.** Raymer, M.G. Oregon Univ., Eugene, OR (USA). Dept. of Physics. Feb 1990. 7p. Sponsored by U.S. DOE Energy Research. DOE Contract FG06-88ER13973. Order Number DE91001143. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Significant progress has been made in several areas. The source of mode-intensity fluctuations in a three-mirror, multimode dye laser has been identified in the typical operating regime well above threshold. It was found experimentally that deterministic four-wave mixing interactions are the underlying cause. We have also made new theoretical studies concerning the regime just above threshold and predicted that the mode fluctuations wil. be dominated by quantum noise in this regime. We have constructed a preliminary-design short-cavity dye laser in an attempt to enhance this quantum effect, and are now beginning to characterize its output. We have also constructed a Ti:Sapphire laser, and are beginning its study.

53449 (DOE/ER/25019-20) **Free-electron lasers with very slow wiggler taper.** Bosley, D.L.; Kevorkian, J. Washington Univ., Seattle, WA (USA). Dept. of Applied Mathematics. Sep 1990. 32p. Sponsored by U.S. DOE Energy Research. DOE Contract FG06-86ER25019. Order Number DE91001139. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A highly accurate, explicit asymptotic solution of the electron energy and phase is found for a class of free-electron lasers with very long wavelength beams, very low electron energies, and very slow taper of the wiggler field relative to the wiggler period. Dimensionless variables are defined and normalized, and three small parameters which characterize the operation of the FEL are identified. Because of the explicit nature of the solution, our results may be directly used to calculate features such as the escape distance of the electron from the potential well and the effects of the various physical parameters. One important advantage of the very slow wiggler taper is the increased efficiency of the energy transfer from the electron beam to the signal field due to increased bucket width. Numerical calculations are performed to verify all results. 9 refs., 6 figs.

53450 (LA-UR-90-3233) **Modelling of dual stability in a cable-in-conduit conductor.** Bottura, L. (Max-Planck-Institut fuer Plasmaphysik, Garching (Germany, F.R.). NET Design Team); Minervini, J.V. Los Alamos National Lab., NM (USA). [1990]. 12p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-36. (CONF-900944-4: Applied superconductivity conference, Aspen, CO (USA), 24-28 Sep 1990). Order Number DE91000220. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A zero dimensional stability model has been developed for cable-in-conduit superconductors. The model is effective in simulating the multi-valued stability behaviour in the vicinity of the limiting current. This has been by modifying the helium heat transfer coefficient to account for inertial and fractional terms which affect the induced helium flow. Although this effect is treated qualitatively on a pseudo-one-dimensional basis, the model can reproduce with remarkable accuracy the multi-valued stability behaviour shown in earlier measurements performed by Lue, et al. The influence of the steady state mass flow is discussed, and a first order approximation of its effect is introduced in the model showing how an increase of the steady flow tends to "wash-away" the multiple stability region as observed in the experiment.

53451 (SAND-90-1122) **Detection and frequency tracking of chirping signals.** Elliott, G.R.; Stearns, S.D. Sandia National Labs., Albuquerque, NM (USA). Aug 1990. 14p. Sponsored by

U.S. DOE Energy Research. DOE Contract AC04-76DP00789. Order Number DE91000470. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This paper discusses several methods to detect the presence of and track the frequency of a chirping signal in broadband noise. The dynamic behavior of each of the methods is described and tracking error bounds are investigated in terms of the chirp rate. Frequency tracking and behavior in the presence of varying levels of noise are illustrated in examples. 11 refs., 29 figs.

53452 (SAND–90-1169C) **The use of light emission in failure analysis of CMOS ICs.** Hawkins, C.F. (New Mexico Univ., Albuquerque, NM (USA). Dept. of Electrical and Computer Engineering); Soden, J.M.; Cole, E.I. Jr.; Snyder, E.S. Sandia National Labs., Albuquerque, NM (USA). [1990]. 13p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-9010148–1: 16. international symposium and exposition for testing and failure analysis, Los Angeles, CA (USA), 26 Oct - 7 nov 1990). Order Number DE91001234. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The use of photon emission for analyzing failure mechanisms and defects in CMOS ICs is presented. Techniques are given for accurate identification and spatial localization of failure mechanisms and physical defects, including defects such as short and open circuits which do not themselves emit photons.

53453 (SAND–90-1770C) **Characterization of semiconductor surface-emitting laser wafers.** Gourley, P.L.; Vawter, G.A.; Brennan, T.M.; Hammons, B.E. Sandia National Labs., Albuquerque, NM (USA). [1990]. 11p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-901073–8: 178. meeting of the Electrochemical Society, Seattle, WA (USA), 14-19 Oct 1990). Order Number DE91001336. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The development of epitaxial semiconductor surface-emitting lasers has begun in recent years. These lasers are ultra-short (few μm) Fabry-Perot resonators comprising epitaxial multilayer semiconductor mirrors and quantum well active regions. The resonators are single crystals grown along the lasing axis by molecular beam epitaxy (MBE) or chemical vapor deposition (CVD). They offer significant advances over conventional cleaved, edge-emitting lasers for creating lasers with single elements of 2 dimensional arrays, low beam divergence, engineered active regions, single longitudinal modes, and improved temperature characteristics. To realize the high potential of these new laser structures, techniques for characterizing the laser wafer after growth and between fabrication steps must be developed. In this paper we discuss several optical techniques that we have developed for this emerging surface-emitting laser technology.

53454 (SAND–90-2244C) **A Josephson junction to FET high speed line driver made of TlCaBaCuO.** Martens, J.S. (Sandia National Labs., Albuquerque, NM (USA)); Ginley, D.S.; Beyer, J.B.; Nordman, J.E.; Hohenwarter, G.K.G. Sandia National Labs., Albuquerque, NM (USA). [1990]. 20p. Sponsored by U.S. Department of Defense; U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-900944–1: Applied superconductivity conference, Aspen, CO (USA), 24-28 Sep 1990). Order Number DE90017542. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

We have used a Tl-Ca-Ba-Cu-O superconducting flux flow transistor (SFFT) as an active impedance converter between Josephson and FET circuitry. The input of the flux flow device is a control line of low impedance that can be driven by a tunnel junction. The output is the signal across the SFFT which is made of a parallel array of weak links. The output impedance is typically greater than 5 Ω with a maximum voltage swing of over 100 mV into a 50 Ω system. The switching of an all-Nb junction induced a 90 mV voltage swing at the FET input and over 200 mV at the FET output. The line driver can operate anywhere between 4.2K and 85K with minor changes in speed ($\pm$5 ps) and output level ($\pm$10 mV). The switching time measured was about 100 ps and was fixture limited. 13 refs., 5 figs.

53455 (SAND–90-2291C) **Hole-trapping/hydrogen transport $(HT)^2$ model for interface-trap buildup in MOS devices.** Shaneyfelt, M.R.; Schwank, J.R.; Fleetwood, D.M.; Winokur, P.S. Sandia National Labs., Albuquerque, NM (USA). [1990]. 3p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-901235–2: 21. IEEE semiconductor interface specialists conference, San Diego, CA (USA), 6-8 Dec 1990). Order Number DE91000020. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The electric field dependence of radiation-induced interface-trap formation has been reported to be different for metal-gate capacitors and polysilicon-gate capacitors and transistors. For metal-gate capacitors, interface-trap formation steadily increases with increasing positive field. On the other hand, for polysilicon-gate capacitors and transistors, interface-trap buildup peaks near fields of 1 MV/cm to 2 MV/cm and decreases with an approximate $E^{-1/2}$ dependence at higher fields. The previously reported field dependence for interface-trap generation for Al-gate capacitors is consistent at all fields with McLean's physical explanation of the two-stage process, which depends on hydrogen ion (H^+) release in the bulk of the oxide as radiation-induced holes transport to either interface via polaron hopping. Above 1 MV/cm, the field dependence of interface-trap buildup for polysilicon-gate devices is inconsistent with this model. Instead, it is similar to the field dependence for hole-trapping in SiO_2, suggesting that hole trapping may play a key role in interface-trap generation in Si-gate devices. However, recent studies of the time-dependence of interface-trap buildup have known that hole trapping cannot be the rate-limiting step in interface-trap buildup in polysilicon gate devices. Consistent with McLean's physical explanation of the two-stage process, the rate-limiting step in interface-trap formation appears to be H^+ transport to the Si/SiO_2 interface. We will show that the electric field dependence of radiation-induced oxide- and interface-trap charge buildup for both polysilicon and metal-gate transistors follows an approximate $E^{-1/2}$ field dependence over a wide range of electric fields when electron-hole recombination effects are included. Based on these results a hole trapping/hydrogen transport $(HT)^2$ model for interface-trap buildup is proposed.

53456 (UCRL-JC–103354) **Ultra-high brightness (10^{21} W/cm^2) laser facility.** Perry, M.D. (Lawrence Livermore National Lab., CA (USA)); Campbell, E.M.; Hunt, J.T.; Keane, C.; Szoke, A.; Mourou, G.; Bado, P.; Maine, P. Lawrence Livermore National Lab., CA (USA). 21 Mar 1990. 44p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-9003224–1: Briefing for NAS Soviet delegation visit to Lawrence Livermore National Laboratory (LLNL), Livermore, CA (USA), 22 Mar 1990). Order Number DE91001685. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

New short-pulse laser technology has made possible the production of extremely bright laser sources. The use of these new techniques on large scale Nd:Glass based laser systems would make it possible to produce 1000 TW (Petawatt) pulses. Such pulses would yield focused intensities exceeding 10^{21}W/cm^2 corresponding to an electric field in excess of 100 e/a_0^2 and an energy density equivalent to that of a 10 keV blackbody. Such a source would have important applications in x-ray laser research and lead to a fundamentally new class of experiments in atomic, nuclear, solid state, plasma and high-energy density physics. Such a facility could be constructed with existing "chirped-pulse" technology. A one-year period of research addressing outstanding technical questions can extend the technology resulting in a more compact and cost effective design. For this reason, we are seeking a Director's Initiative grant in the amount of $590,000 for FY89 to investigate these issues. An equivalent amount in personnel and facilities would be provided by Y-Division. The study will include development of a "chirped-pulse" front-end capable of producing laser pulses of 2 J at 1.053 μm with a 1 psec pulsewidth laser. Upon completion, this front-end will be installed on the Nova laser system in order to investigate propagation and compression issues associated with amplification of a chirped-pulse. Our goal is to demonstrate the production of 100 TW pulses using a portion of a Nova beamline.

53457 (UCRL-JC–104830) **Simulation, design, and fabrication of thin-film resistive-gate GaAs charge coupled devices.** Ula, N. (California Univ., Davis, CA (USA). Dept. of Electrical Engineering and Computer Science); Hunt, C.E.; Cooper, G.; Davidson,

C.; Swierkowski, S.P. Lawrence Livermore National Lab., CA (USA). [1990]. 5p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-901244–2: 1990 international electron device conference, San Francisco, CA (USA), 10-12 Dec 1990). Order Number DE91000419. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Computer simulation of high-speed Gallium Arsenide Charge Coupled Devices is performed using the two-dimensional semiconductor device simulation program BAMBI (Basic Analyzer for Mos and Bipolar devices). The effect of active layer thickness and doping concentration on the Charge Transfer Efficiency (CTE) and the dynamic range is investigated using different active layers. Also, different gate architectures are compared for optimum dynamic range and compatibility with GaAs MESFET technology. Both Capacitive Gate CCD (CGCCD) and Resistive Gate CCD (RGCCD) are considered. The measured performance of the fabricated GaAs CCD is compared with modelled results. 2 refs., 2 figs.

53458 The nonlinear description of a plasma maser. Murukesapillai, K. (Cornell Univ., Ithaca, NY (USA). Lab. of Plasma Studies); Hamza, A.M. 25p. Laboratory of Plasma Studies, Cornell University, Ithaca, NY (USA) (1990).

Technical Paper LPS90-7.

This paper addresses a plasma-microwave system proposed for the production of microwave radiation. The device exploits the electromagnetic instabilities of nonequilibrium plasmas. During single-mode operation of the plasma maser, the resonant particles become trapped and cease to radiate before a substantial fraction of the energy available could be extracted from the plasma in the form of radiation. This is not true for multi-mode operation. During multi-mode operation, the total energy available is distributed over a large number of resonant lines and the amplitudes of the various frequency components of the waves are not at all large enough to cause particle trapping and subsequently saturation. Thus, the linear theory remains valid until the anisotropy disappears due to radiation.

53459 Short and ultrashort wavelength lasers: Proceedings of the 1 Workshop. Jones, C.R. (Los Alamos National Lab., Los Alamos, NM (US)). 193p. Society of Photo-Optical Instrumentation Engineers, Bellingham, WA (USA) (1988). (CONF-8801144–: Short and ultrashort wavelength lasers meeting, Los Angeles, CA (USA), 14-15 Jan 1988).

This book presents new experimental and theoretical research on x-ray, gamma-ray, and short wavelength chemical (SWCL) lasers, which are being investigated for military as well as other directed energy applications. Topics include lasing schemes for x-ray lasers, studies of candidate isomers for gamma-ray laser concepts, and progress in pulsed and cw SWCLs.

53460 Pulsed-power driven x-ray lasers: Fantasy or reality. Apruzese, J.P. (Naval Research Lab., Washington, DC (USA)); Davis, J. pp. 7-12 of Lasers '89. Harris, D.G.; Shay, T.M. STS Press, McLean, VA (USA) (1990). pp. 1159 (CONF-891261–: Lasers '89: 12th international conference on lasers and applications, New Orleans, LA (USA), 3-8 Dec 1989).

All existing laboratory x-ray lasers utilize as a gain medium a linear plasma created by a line-focused high power Nd:glass or CO_2 laser. In this paper, the authors asses the prospects of creating an x-ray laser by employing pulsed electrical discharges as the energy source for the plasma gain medium. Progress toward achieving a pulsed-power driven soft x-ray laser via electron pumping and/or photoexcitation is reviewed. Advantages and disadvantages of pulsed-power drivers compared to laser drivers are discussed. At present, resonant photoexcitation appears to be the most promising candidate for early success as a pulsed-power x-ray laser.

53461 Results of the PALADIN experiment. Weir, J.T. (Lawrence Livermore National Lab., CA (USA)); Orzechowski, T.J.; Miller, J.L.; Chong, Y.P.; Chambers, F.; Deis, G.A.; Paul, A.C.; Prosnitz, D.; Scharlemann, E.T.; Halbach, K. pp. 97-101 of Free-electron lasers 2: Volume 1133. Petroff, Y. Society of Photo-Optical Instrumentation Engineers, Bellingham, WA (USA) (1989). pp. 119 DOE Contract AC03-76SF00098. (CONF-8904242–: OPTO '89: international congress on optical science and engineering, Paris (France), 24-28 Apr 1989).

PALADIN is a single pass, free electron laser amplifier located at the lawrence Livermore National Laboratory. This FEL is designed to run at 10.6 μm. The 1-kA, 45-MeV electron beam is provided by the Advanced Test Accelerator. The wiggler is 25 m long with an 8 cm period. The input optical signal to the amplifier is provided by a conventional CO_2 laser, which can produce a peak input power of either 18 kW or 3.6 MW. We have demonstrated 31 dB of gain with the 18-kW input and 12.9 dB of gain for the 3.6-MW input, producing over 70 MW of optical power. Using the 18-kW input, the gain saturated at about 12 m into the wiggler; with the 3.6-MW input, the gain saturated at about 8 m. Modeling results are shown.

53462 Calculation of harmonic radiation and nuclear coupling arising from atoms in strong laser fields. Rinker, G.A. (Theoretical Div., Los Alamos National Lab., Los Alamos, NM (US)); Solem, J.C.; Biedenharn, L.C. pp. 92-100 of Short and ultrashort wavelength lasers. Jones, C.R. Society of Photo-Optical Instrumentation Engineers, Bellingham, WA (USA) (1988). pp. 193 (CONF-8801144–: Short and ultrashort wavelength lasers meeting, Los Angeles, CA (USA), 14-15 Jan 1988).

A numerical, time-dependent quantum mechanical model is used to describe the interaction of an isolated ion with an intense applied laser field, including both electron and nuclear degrees of freedom. Calculated results are presented. The authors find that the model ion radiates in low odd harmonics of the laser frequency, in qualitative agreement with experimental observations. In addition, it radiates strongly in the x-ray region, at frequencies comparable with the electron Rydberg frequency. Such radiation should be possible to observe in future experiments. If it exists, it could provide a basis for a reasonably coherent x-ray source. The authors find that the probability of induced nuclear excitation is small for higher electric multipoles, although observable probabilities are obtained under appropriate circumstances for L=1.

53463 A soft x-ray free electron laser (FEL) using a two-beam elliptical pill-box wake-field cavity. Kim, S.H. (Center for Accelerator Science and Technology, Univ. of Texas at Arlington, Arlington, TX (US)); Chen, K.W. pp. 60-64 of Short and ultrashort wavelength lasers. Jones, C.R. Society of Photo-Optical Instrumentation Engineers, Bellingham, WA (USA) (1988). pp. 193 (CONF-8801144–: Short and ultrashort wavelength lasers meeting, Los Angeles, CA (USA), 14-15 Jan 1988).

Stimulated bremsstrahlung in an undulating electric field in the lasing beam direction (electric wiggler) was shown to be possible from the quantum- mechanical viewpoint. Herein, this possibility is scrutinized from the viewpoint of classical electrodynamics. It is found that if stimulated bremsstrahlung in a transverse undulating magnetic field (magnetic wiggler) occurs, stimulated bremsstrahlung in the electric wiggler must also occur. We further show that a free electron laser (FEL) using a magnetic wiggler to provide a catalyzer field for stimulated bremsstrahlung cannot serve as a practical FEL operating in the soft x-ray region from both theoretical and experimental viewpoints. On the other hand, the authors demonstrate that the FEL using a traveling wake field in a two-beam elliptical pill-box cavity is well suited as a source of coherent radiation in the soft x-ray region.

53464 Gain optimization and saturation of the Xe III 109 nm auger laser. Macklin, J.J. (Stanford Univ., Edward L. Ginzton Lab., Stanford, CA (US)); Sher, M.H.; Barty, C.P.J.; King, D.A.; Yin, G.Y.; Harris, S.E.; Young, J.F. pp. 44-47 of Short and ultrashort wavelength lasers. Jones, C.R. Society of Photo-Optical Instrumentation Engineers, Bellingham, WA (USA) (1988). pp. 193 (CONF-8801144–: Short and ultrashort wavelength lasers meeting, Los Angeles, CA (USA), 14-15 Jan 1988).

The authors describe the construction and operation of a 109 nm, photoionization-pumped, single-pass laser in Xe III. The laser is pumped by soft x-rays emitted from a laser-produced plasma in a traveling-wave geometry. Using a 3.5 J, 300 psec, 1064 nm laser pump pulse, they measure a small-signal gain coefficient of 4.4 cm^{-1} and a total small signal gain of exp(40). The laser is fully saturated and produces an output energy of 20 μJ in a beam with 10 mrad divergence.

53465 Structure of $ErBa_2Cu_3O_x$ in the composition range $6.1 \leq x \leq 7.0$. Porschke, E. (Institut fur Festkorperforschung, KFA

Julich (DE)); Meuffels, P.; Rupp, B. pp. 181-186 of Neutron scattering for materials science. Shapiro, S.M.; Moss, S.C.; Jorgensen, J.D. Materials Research Society, Pittsburgh, PA (USA) (1990). pp. 499 (CONF-891119–: Materials Research Society fall meeting, Boston, MA (USA), 27 Nov - 2 dec 1989).

The structure of a series of homogeneous $ErBa_2Cu_3O_x$ powder samples ($6.1 \leq x \leq 7.0$) has been determined by elastic neutron scattering using the Rietveld method of profile refinement. All samples were prepared in the same way using a defined absorption-desorption method. By removing oxygen the c axis expands, whilst the Cu2-Cu2 and the Ba-Ba distances contract. Accordingly, the most significant changes in atomic distances occur between the Cu2-02,3 planes and the Cu1-04-Cu1 chains. With decreasing oxygen content the distance between the Cu-O planes and the Cu-O-Cu chains increases and the oxygen (0,O,z) apex atom 01 moves closer to the Cu-O-Cu chains withdrawing from the Cu-O planes.

53466 Multiplexed, high-and low-sensitivity fiber-optic strain/temperature sensor. Muhs, J.D. (Applied Technology Div., Oak Ridge National Lab., Oak Ridge, TN (US)). pp. 172-176 of Fiber optic and laser sensors VII: Volume 1169. Udd, E.; De Paula, R.P. Society of Photo-Optical Instrumentation Engineers, Bellingham, WA (USA) (1989). pp. 600 (CONF-8909177–: O/E Fibers '89: meeting of the International Society for Optical Engineering, Boston, MA (USA), 5-8 Sep 1989).

An intrinsic, wavelength-division-multiplexed, high- and low-sensitivity fiber-optic sensor is proposed and analyzed as a possible alternative to the existing optical fiber-sensing methods used in real-time temperature and strain evaluations. The sensor unites two existing technologies: the dual core, single-mode, cross-talk phenomena exhibiting relatively low sensitivity and the Fabry-Perot interferometric sensing phenomena that is known for its high sensitivity. The sensor uses the wavelength sensitivity of fused, tapered, single-mode couplers as a method of multiplexing the two widely exploited sensors outlined above. The sensor configuration consists of two independent coherent sources of differing wavelengths, a wavelength division multiplexer/demultiplexer, a center-cleaved, fused, biconnically tapered, single-mode coupler/splitter, and partially reflective, mirrored surfaces at designated locations along the fiber. Thus, a unique sensing arrangement having two independent (high- and low-sensitivity) sensors functioning simultaneously is realized.

53467 Mossbauer effect experiments applicable to Grasers. Taylor, R.D. (Los Alamos National Lab., Physics Div., Los Alamos, NM (US)); Hoy, G.R. pp. 126-134 of Short and ultrashort wavelength lasers. Jones, C.R. Society of Photo-Optical Instrumentation Engineers, Bellingham, WA (USA) (1988). pp. 193 (CONF-8801144–: Short and ultrashort wavelength lasers meeting, Los Angeles, CA (USA), 14-15 Jan 1988).

Gamma-ray experiments involving the Mossbauer Effect and multibeam Borrmann Effect in single crystal silver are reported. Calculations for multibeam radiation modes for electronic scattering in a (111)-oriented crystal of iron are described.

53468 Extension of nuclear structure data base searches for gamma-ray laser candidates. Arthur, E.D. (Theoretical Div., Los Alamos National Lab., Los Alamos, NM (US)); Madland, D.G.; George, D.C. pp. 117-119 of Short and ultrashort wavelength lasers. Jones, C.R. Society of Photo-Optical Instrumentation Engineers, Bellingham, WA (USA) (1988). pp. 193 (CONF-8801144–: Short and ultrashort wavelength lasers meeting, Los Angeles, CA (USA), 14-15 Jan 1988).

Results from a data base search of computerized nuclear structure libraries have been extended and augmented so as to expand the information available for nuclei suitable as gamma-ray laser candidates. The spectrum of nuclear levels occurring in deformed rotational nuclei have been calculated and have been used in conjunction with isomeric state data for odd-A systems. The results of this augmentation effort are presented with particular emphasis on results obtained for ^{177}Lu, ^{177}Hf, and ^{179}Hf. For these cases some possibly interesting cases were identified that meet energy spacing criteria. However, significant hindrance factors exist for them which negate their interest for gamma-ray laser applications.

53469 Beam propagation in direct nuclear pumped laser amplifiers. Neuman, W.A. (Idaho National Engineering Lab., Idaho Falls, ID (USA)); Fincke, J.R.; Lassahn, G.D.; Montierth, L.M. pp. 278-288 of Lasers '89. Harris, D.G.; Shay, T.M. STS Press, McLean, VA (USA) (1990). pp. 1159 DOE Contract AC07-76ID01570. (CONF-891261–: Lasers '89: 12th international conference on lasers and applications, New Orleans, LA (USA), 3-8 Dec 1989).

Thermal distortions in transverse flow, direct nuclear pumped laser amplifiers and the resulting effect on beam propagation is investigated. Nuclear pumping occurs from surfaces, either from plates parallel to the flow direction, from screens or porous material perpendicular to the flow direction, or from the combination of the two. The analysis presented is topically divided into the analysis of the energy deposition of the energetic charged particles in the amplifying media and the analysis of the beam propagation in the amplifier and to the far field. The spatially varying energy deposition produces large index of refraction variations in the nuclear pumped amplifier. These variations are modeled by a Zernike polynomial expansion and their effect on the propagation of a uniform intensity plane wave is discussed. For purposes of illustration, an amplifier with a 1 m gain length and a atm (101 kPa) argon gas flowing at 100 m/s is presented.

53470 Nuclear-induced UV fluorescence for stimulation of the atomic iodine laser. Williams, W.H. (Illinois Univ., Urbana, IL (USA). Fusion Studies Lab.); Miley, G.H.; Chung, H.J. pp. 270-277 of Lasers '89. Harris, D.G.; Shay, T.M. STS Press, McLean, VA (USA) (1990). pp. 1159 (CONF-891261–: Lasers '89: 12th international conference on lasers and applications, New Orleans, LA (USA), 3-8 Dec 1989).

A study is in progress to investigate the nuclear-induced fluorescence of the eximer XeBr for application in the atomic iodine laser. Measurements of fluorescence induced by the $^{10}B(n,^4He)^7Li$ reaction in varying gas mixtures with Br_2 and $CHBr_3$ as bromine donors are presented. A conceptual design of the photolytic laser planned to utilize this fluorescence is also discussed.

53471 Laser diode cooling for high average power applications. Mundinger, D. (Lawrence Livermore National Lab., Livermore, CA (US)); Beach, R.; Benett, W.; Solarz, R.; Sperry, V. pp. 351-358 of Laser diode technology and applications. Figueroa, L. Society of Photo-Optical Instrumentation Engineers, Bellingham, WA (USA) (1989). pp. 392 (CONF-890145–: OE/LASE '89: SPIE conference on optics, electro-optics and laser applications in science and engineering, Los Angeles, CA (USA), 15-20 Jan 1989).

Many applications for semiconductor lasers that require high average power are limited by the inability to remove the waste heat generated by the diode lasers. In order to reduce the cost and complexity of these applications a heat sink package has been developed which is based on water cooled silicon microstructures. Thermal resistivities of less than $0.025°C/(W/cm^2)$ have been measured which should be adequate for up to CW operation of diode laser arrays. This concept can easily be scaled to large areas and is ideal for high average power solid state laser pumping. Several packages which illustrate the essential features of this design have been fabricated and tested. The theory of operation is covered, and several conceptual designs are described. Also the fabrication and assembly procedures and measured levels of performance are discussed.

53472 Operational characteristics of an imaging, unstable ring resonator using Nd:YLF as active medium. Park, D.Y. (Physics Dept., INHA Univ., Inchon (KR)); Seka, W.; Lin, Y.; Brown, D.L. pp. 449-456 of Lasers '89. Harris, D.G.; Shay, T.M. STS Press, McLean, VA (USA) (1990). pp. 1159 (CONF-891261–: Lasers '89: 12th international conference on lasers and applications, New Orleans, LA (USA), 3-8 Dec 1989).

The authors have constructed and tested an imaging resonator using Nd:YLF as the active medium. Incorporated in this oscillator are a small angle Faraday rotator and a pair of etalons (10 mm, R = 60%, and 2 mm, R = 25%) that guarantee unidirectional, single-axial-mode operation of the oscillator. Q-switched monomode operation is obtained through self-injection seeding. The oscillator has been characterized in the time, frequency, phase, and spatial

domain using fast diodes, high-resolution interferometry and near-field photography.

53473 Wavefront and depolarization calculations for a GGG slab laser. Blink, J.A. (Lawrence Livermore National Lab., CA (USA)); Cook, J.L.; Zapata, L.E. pp. 458-464 of Lasers '89. Harris, D.G.; Shay, T.M. STS Press, McLean, VA (USA) (1990). pp. 1159 DOE Contract W-7405-ENG-48. (CONF-891261–: Lasers '89: 12th international conference on lasers and applications, New Orleans, LA (USA), 3-8 Dec 1989).

For a vortex-stabilized-lamp pumped, zigzag GGG slab amplifier with diffuse and specular reflectors, the transient-3D Tecate codes calculated the temperature, deformation, stress, wavefront, and depolarization for several estimated and measured source distributions. These calculations are presented.

53474 Excimer lasers and LIDAR. Sze, R.C. (Los Alamos National Lab., NM (USA)). pp. 526-530 of Lasers '89. Harris, D.G.; Shay, T.M. STS Press, McLean, VA (USA) (1990). pp. 1159 (CONF-891261–: Lasers '89: 12th international conference on lasers and applications, New Orleans, LA (USA), 3-8 Dec 1989).

Excimer lasers used in LIDAR applications have a number of benefits over lasers at other wavelengths. Among these is that the signal wavelengths can be in the solar blind region permitting comparable signal to noise ratios for both day and night time detection. The authors give a specific example for the most common use of an excimer laser in LIDAR, that of inducing fluorescence or Raman scattering in species of interest. They discuss some recent laser developments including multi-wavelength, long-pulse, and ultra short-pulse lasing, and show how they maybe used for atmospheric and hydrographic LIDAR applications.

53475 Cloud hole boring with infrared lasers: Theory and experiment. Caramana, E.J. (Los Alamos National Lab., NM (USA)); Morse, R.L.; Quigley, G.P.; Stephens, J.R.; Webster, R.B.; York, G.W. pp. 659-663 of Lasers '89. Harris, D.G.; Shay, T.M. STS Press, McLean, VA (USA) (1990). pp. 1159 (CONF-891261–: Lasers '89: 12th international conference on lasers and applications, New Orleans, LA (USA), 3-8 Dec 1989).

Results of experimental attempts to produce an optically clear channel in a water cloud by evaporating the cloud droplets with a CO_2 laser are presented. Using scattered light it is possible to visualize the clear channel produced. Measurements of the fraction of power transmitted through the channel at visible wavelengths give insight into the clearing mechanisms. The present data suggest that the water droplets explode in the process of clearing. A theoretical explanation of why this should occur is presented and predictions of the onset of droplet explosions are made.

53476 Propagation of high energy laser beams through clear air in the. Chitanvis, S.M. (Los Alamos National Lab., NM (USA)); Salesky, E.T. pp. 703-708 of Lasers '89. Harris, D.G.; Shay, T.M. STS Press, McLean, VA (USA) (1990). pp. 1159 (CONF-891261–: Lasers '89: 12th international conference on lasers and applications, New Orleans, LA (USA), 3-8 Dec 1989).

Large aperture, high energy gas lasers are expected to propagate in the T^3 thermal blooming regime through the atmosphere. Turbulence also has to be accounted for> The authors study the effect of atmospheric propagation on the beam using two models. The first model is a semi-analytic approach, in which we solve the differential equation for the mutual coherence function, which accounts for both thermal blooming and turbulence, using a generalization of the so-called aberrationless approximation. The resulting coupled ordinary differential equations were solved numerically. Secondly, the authors have investigated the deterioration of the laser beam using an FFT (Fast Fourier Transform) based code. The Strehl ratios obtained by both methods were compared, and we achieved good agreement, with errors of only a few percent. Based on their analysis, the authors point out that shortening the pulse length and increasing the flux, while keeping the fluence of the laser fixed, results in an increased Strehl ratio in the t^3 thermal blooming regime.

53477 Experimental results of aging and thermal effects in high-power laser diodes. Rupert, J.W. (Sandia National Labs., Albuquerque, NM (USA)); Mittas, A.; Woolston, T.L.; Landry, M.J. pp. 882-891 of Lasers '89. Harris, D.G.; Shay, T.M. STS Press, McLean, VA (USA) (1990). pp. 1159 (CONF-891261–: Lasers '89: 12th international conference on lasers and applications, New Orleans, LA (USA), 3-8 Dec 1989).

This paper describes the aging and thermal effects on high-power GaAlAs laser diodes constructed by Spectra Diode Laboratory (SDL) with multiple stripes, containing single-and multiple-quantum wells. Thermal effects are described for laser diodes constructed by McDonnell Douglas Astronautics Company/ Optoelectronics Center (MDAC/OEC) with a single broad stripe containing a single-quantum well. The laser diodes are grown using metalorganic chemical vapor deposition (MOCVD). Experimental data are given showing the aging and thermal effects of these laser diodes while operating CW for different on-times and operating up to 2.0 W for an overdriven SDL commercial laser diode, 4.0 W for a SDL engineering prototype and 5.0 W for a MDAC/OEC prototype. Thermal effects are observed by operating at different intervals between shots and power levels when cooled by a fin heat-sink or thermoelectric cooler.

53478 Temperature measurement with hydrogen pure rotational CARS spectrum. Singh, J.P. (Diagnostic Instrumentation and Analysis Lab., Mississippi State Univ., Mississippi State, MS (US)); Yueh, F.Y. pp. 854-857 of Lasers '89. Harris, D.G.; Shay, T.M. STS Press, McLean, VA (USA) (1990). pp. 1159 (CONF-891261–: Lasers '89: 12th international conference on lasers and applications, New Orleans, LA (USA), 3-8 Dec 1989).

Multiplex rotation CARS spectra of H_2 have been recorded in a quartz cell placed in a furnace. The Stokes laser was tuned to the desired spectral region to obtain the H_2 pure rotational lines S(4) and S(5) with comparable intensity in the temperature range 800 K-1500 K. The observed spectra were fit with model spectra to extract the temperature. The temperature measurements with the normalized intensities ratio for S(4) and S(5) are demonstrated.

53479 Development of solar-powered infrared injection laser microminiature transmitting system. Falter, D.D. (Oak Ridge National Lab., TN (USA). Instrumentation and Controls Div.); Alley, G.T.; Falter, K.G.; Rochelle, J.M.; Valentine, K.H.; Westbrook, R.D.; Jellison, G.E. Jr.; Fleming, P.H. pp. 1081-1087 of Lasers '89. Harris, D.G.; Shay, T.M. STS Press, McLean, VA (USA) (1990). pp. 1159 DOE Contract AC05-84OR21400. (CONF-891261–: Lasers '89: 12th international conference on lasers and applications, New Orleans, LA (USA), 3-8 Dec 1989).

This paper reports on a solar-powered infrared microminiature transmitting system developed to provide scientists with a tool to continuously track and study Africanized bees. Present tracking methods have limited ranges and the lack the capability of continuously tracking individual insects. Preliminary field tests of a stationary prototypic transmitter have demonstrated a range of 1.1 km. The basic design consists of an array of nine 1-mm^2 solar cells, which collect energy for storage in a 1.0-μF tantalum chip capacitor. When the capacitor has been charged to a sufficient level, the circuitry that monitors the capacitor voltage level wakes up and fires a %-μs pulse through an 840-nm GaAlAs injection laser diode. The process is then repeated, making the signal frequency (which ranges from 50 to 300 Hz) dependent on solar luminance. The solar cells, capacitor, and laser diode are mounted in hybrid microcircuit fashion directly on the silicon substrate containing the CMOS control and driver circuitry. The transmitter measures ~4 x 6 mm and weighs ~65 mg. The receiving system is based on an 8-in. telescope and a Si PIN diode detector.

53480 Nonlinear analysis of wiggler taper, mode competition, and space-charge effects for a 280-GHz free electron laser. Chang, S.F.R. (Wisconsin Univ., Madison, WI (USA). Dept. of Electrical and Computer Engineering); Joe, J.; Scharer, J.E. *IEEE Transactions on Plasma Science (Institute of Electrical and Electronics Engineers) (USA),* 18(3): 451-459 (Jun 1990). Grant ECS-8514978.

The nonlinear characteristics of a 280-GHz free electron laser (FEL) are simulated by numerical computation. The three-dimensional set of coupled nonlinear differential equations is solved for a set of TE and TM modes valid for the high gain Compton regime. The use of a nonlinear taper for efficiency enhancement,

the sensitivity of gain to competing mode power levels, space-charge effects, and the effect of electron beam source distributions on gain and efficiency are examined for a 10-MeV 3-kA beam. It is found that the nonlinear taper greatly enhances the gain and efficiency and makes the saturation power levels relatively insensitive to the competing mode power levels. The efficiency is increased to 48% by means of a nonlinear taper in which the 3-D and wiggler-averaged codes are compared and the effects of space charge are found to reduce the efficiency to a level of 32%. The effect of beam quality in terms of the four volume phase space is examined and found to have an observable effect at this wavelength.

53481 Surface mount component jig. Kronberg, J.W. To Dept. of Energy, Washington, DC (USA). USA Patent 4,945,953/A/. 7 Aug 1990. Filed date 2 May 1989. USA Patent patents application 7-346,761. Int. Cl. B21F 11/00. 3p. Source: Patent and Trademark Office, Box 9, Washington, DC 20232 (USA).

This patent describes a device for bending and trimming the pins of a dual-inline package component and the like for surface mounting rather than through mounting to a circuit board comprises, in a first part, in pin cutter astride a holder having a recess for holding the component, a first spring therebetween, and, in a second part, two flat members pivotally interconnected by a hinge and urged to an upward peaked position from a downward peaked position by a second spring. As a downward force is applied to the pin cutter it urges the holder downward, assisted by the first spring and a pair of ridges riding on shoulders of the holder, to carry the component against the upward peaked flat members which guide the pins outwardly. As the holder continues downwardly, the flat members pivot to the downward peaked position bending the pins upwardly against the sides of the holder. When the downward movement is met with sufficient resistance, the ridges of the pin cutter ride over the holder's shoulders to continue downward to cut any excess length of pin.

53482 Semiconductor devices incorporating multilayer interference regions. Biefeld, R.M.; Drummond, T.J.; Gourley, P.L.; Zipperian, T.E. To Dept. of Energy, Washington DC (USA). USA Patent 4,947,223/A/. 7 Aug 1990. Filed date 31 Aug 1987. USA Patent patents application 7-091,560. Int. Cl. H01L 27/14. 6p. Source: Patent and Trademark Office, Box 9, Washington, DC 20232 (USA).

This patent describes a semiconductor high reflector comprising a number of thin alternating layers of semiconductor materials is electrically tunable and may be used as a temperature insensitive semiconductor laser in a Fabry-Perot configuration.

53483 Novel fluorinated laser dyes. Hammond, P.R.; Freemen, J.F. To Dept. of Energy, Washington, DC (USA). USA Patent 4,945,176/A/. 31 Jul 1990. Filed date 8 Jun 1989. USA Patent patents application 7-373,316. Int. Cl. C07D 311/82. 4p. Source: Patent and Trademark Office, Box 9, Washington, DC 20232 (USA).

A class of dye is presented which is particularly efficient and stable for dye layer applications, lasing between 540 and 570 nm.

53484 Laser-beam stop. Thompson, R.B. To Department of the Navy, Washington, DC. USA Patent Application 7-531,422. 13 May 1990. 11p. Source: NTISPC N03/MF A01.

This Government-owned invention available for U.S. licensing and, possibly, for foreign licensing. Copy of application available NTIS.

A laser beam stop is constructed having a uniquely designed cell filled with a solution or suspensions of an absorbing species chosen to absorb the wavelength of light emitted by the laser. The position and strength of the laser beam are indicated by the strength and depth of penetration of the fluorescence excited by the laser.

43 PARTICLE ACCELERATORS

Refer also to citation(s) 53980

4301 Design, Development, and Operation

Refer also to citation(s) 53446, 53456

53485 (CERN–90-05) **Accelerators for the twenty-first century - a review.** Wilson, E.J.N. European Organization for Nuclear Research, Geneva (Switzerland). 29 May 1990. 34p. Order Number DE91605952. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

Modern synchrotrons and storage rings are based upon the electrical technology of the 1900s boosted by the microwave radar techniques of World War II. This method of acceleration now seems to be approaching its practical limit. It is high time that we seek a new physical acceleration mechanism to provide the higher energies and luminosities needed to continue particle physics beyond the machines now on the stocks. Twenty years is a short time in which to invent, develop, and construct such a device. Without it, high-energy physics may well come to an end. Particle physicists and astrophysicists are invited to join accelerator specialists in the hunt for this new principle. This report analyses the present limitations of colliders and explores some of the directions in which one might look to find a new principle. Chapters cover proton colliders, electron-positron colliders, linear colliders, and two-beam accelerators; transverse fields, wake-field and beat-wave accelerators, ferroelectric crystals, and acceleration in astrophysics. (orig.).

53486 (CNIC-I–004, pp. 4-5) **Operation of the 2 MV Tandem Accelerator.** China Nuclear Information Centre, Beijing, BJ (China); Academia Sinica, Lanzhou, GS (China). Inst. of Modern Physics. Jun 1990. In *IMP annual report, 1988 (January-December)*. 138p. Order Number DE91606195. Source: NTIS (US Sales Only), PC A07/MF A01; OSTI; INIS.

Published in summary form only. TANDEM ELECTROSTATIC ACCELERATORS/china; TANDEM ELECTROSTATIC ACCELERATORS/operation; CARBON ISOTOPES; EDUCATION; GAMMA RADIATION; NEUTRONS; PHYSICAL RADIATION EFFECTS; RADIATION DOSE DISTRIBUTIONS; SHIELDING; CHINA; OPERATION; USES

53487 (CNIC-I–004, pp. 4) **Operations and improvements of the K-600 cockraft-walton generator.** He Yusheng (China Nuclear Information Centre, Beijing, BJ (China)). China Nuclear Information Centre, Beijing, BJ (China); Academia Sinica, Lanzhou, GS (China). Inst. of Modern Physics. Jun 1990. In *IMP annual report, 1988 (January-December)*. 138p. Order Number DE91606195. Source: NTIS (US Sales Only), PC A07/MF A01; OSTI; INIS.

Published in summary form only. COCKCROFT-WALTON ACCELERATORS/modifications; COCKCROFT-WALTON ACCELERATORS/operation; CHINA; MODIFICATIONS; OPERATION; DEUTERIUM IONS; IRRADIATION; NEUTRON SOURCE FACILITIES; NEUTRONS; SEEDS; USES; WHEAT

53488 (CNIC-I–004, pp. 1) **Status of the 1.7 m SFC in 1988.** Gou Tianen; Zhang Shoujin. China Nuclear Information Centre, Beijing, BJ (China); Academia Sinica, Lanzhou, GS (China). Inst. of Modern Physics. Jun 1990. In *IMP annual report, 1988 (January-December)*. 138p. Order Number DE91606195. Source: NTIS (US Sales Only), PC A07/MF A01; OSTI; INIS.

Published in summary form only. HIRFL CYCLOTRON/beam currents; HIRFL CYCLOTRON/progress report; CARBON 12 BEAMS; CHINA; HARMONICS; MAGNETS; NEON 20 BEAMS; OPERATION; POWER SUPPLIES; RF SYSTEMS; TUNING

53489 (CNIC-I–004, pp. 100) **HIRFL progress in 1988.** Zhang Enhou; Wei Baowen; Bai Guoliang; Ma Shouwu; Ye Feng; Qiao Qingwen. China Nuclear Information Centre, Beijing, BJ (China); Academia Sinica, Lanzhou, GS (China). Inst. of Modern Physics. Jun 1990. In *IMP annual report, 1988 (January-December)*. 138p. Order Number DE91606195. Source: NTIS (US Sales Only), PC A07/MF A01; OSTI; INIS.

Published in summary form only. HIRFL CYCLOTRON/progress report; CARBON IONS; CONSOLES; HISTORICAL ASPECTS; ION SOURCES; OPERATION

53490 (GANIL-P–8918) **The development of heavy-ion research at GANIL.** Detraz, C. Grand Accelerateur National d'Ions Lourds (GANIL), 14 - Caen (France). 1989. 12p. (CONF-8910237–: International school seminar on heavy ion physics, Dubna (USSR), 3-12 Oct 1989). Order Number DE91716317. Source: NTIS (US Sales Only), PC A03/MF A01.

Two scientific domains have been explored very actively at GANIL: the thermodynamic behaviour of nuclear systems with high internal energy, and the properties of light nuclei far from stability. These are fundamental aspects of nuclear physics that beams at energies close to the Fermi energy can most efficiently explore. The aim of GANIL in the coming years is to develop and further improve its research programs in these two areas. The fact that new machines are now providing physicists elsewhere with beams somewhat similar to those from GANIL will contribute to even more fruitful investigations. The current prospects at GANIL aim at better conditions to produce and study rare exotic nuclear species, and to characterize the behaviour of hot excited nuclear matter. In sections 2 and 3, the general objectives of these improvements will be described, while the specific projects, which concern either the accelerator itself or the experimental equipment, will be addressed in section 4 through 7. Broader and longer-term perspectives will be described in section 8.

53491 (KEK–89-21, pp. 329-339) **Review of SC/RF refrigeration systems.** Byrns, R.A. (Lawrence Berkeley Lab., CA (USA)). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Jan 1990. (CONF-8908239–: 4. workshop on RF superconductivity, Tsukuba (Japan), 14-18 Aug 1989). In *Proceedings of the 4th workshop on RF superconductivity.* 910p. Order Number DE90508149. Source: NTIS (US Sales Only), PC A99/MF A01.

A short review is given of historical events in accelerator and cryogenic developments at both Stanford and Berkeley. Methods of refrigeration between 1.85 K and 4.5 K together with modern techniques and improvements are discussed. Where the decade of the 70's was the era of the screw compressor, the 80's can be considered that of the cold vacuum pump for superfluid cooling. Distribution methods are of major importance, and arguments can be made for bath or tube cooling, two-phase, thermo-syphon, supercritical or superfluid. System design affects reliability, safety and operating stability. Distribution costs and heat loads can be a large part of system totals. Some specific system descriptions are included. (author).

53492 (SLAC-PUB–5329) **A summary of ground motion effects at SLAC [Stanford Linear Accelerator Center] resulting from the Oct 17th 1989 earthquake.** Ruland, R.E. Stanford Linear Accelerator Center, Menlo Park, CA (USA). Aug 1990. 25p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00515. (CONF-9009276–1: 2. international workshop on accelerator alignment, Hamburg (Germany, F.R.), 10-12 Sep 1990). Order Number DE91001030. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Ground motions resulting from the October 17th 1989 (Loma Prieta) earthquake are described and can be correlated with some geologic features of the SLAC site. Recent deformations of the linac are also related to slow motions observed over the past 20 years. Measured characteristics of the earthquake are listed. Some effects on machine components and detectors are noted. 18 refs., 16 figs.

4302 Beam Dynamics, Field Calculations, and Ion Optics

Refer also to citation(s) 53461, 54431

53493 (BNL–45152) **Universal scaling function for FEL gain.** Yu, L.H. (Brookhaven National Lab., Upton, NY (USA)); Krinsky, S.; Gluckstern, R.L. Brookhaven National Lab., Upton, NY (USA). [1990]. 15p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. (CONF-9009166–8: 12. international free electron laser conference (FEL-12), Paris (France), 17-21 Sep 1990). Order Number DE91001124. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

We have developed an analytic calculation of FEL gain in the exponential regime taking into account the finite emittance, energy spread, focusing and betatron oscillation of the electron beam, and the diffraction and guiding of the radiation. The gain is expressed in terms of a universal scaling function with only three independent parameters. Excellent agreement is found with results of numerical simulation. 14 refs., 3 figs., 1 tab.

53494 (BNL–45268) **The residual tune splitting in the presence of linear coupling.** Parzen, G. Brookhaven National Lab., Upton, NY (USA). Oct 1990. 11p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. Order Number DE91001132. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The presence of random skew quadrupole field errors will couple the x and y motions. The x and y motions are then each given by the sum of 2 normal modes with the tunes ν_1 and ν_2, which may differ appreciably from ν_x and ν_y, the unperturbed tunes. This is often called tune splitting. This tune splitting may be large in proton accelerators using superconducting magnets, because of the relatively large random skew quadrupole field errors that are expected in these magnets. This tune splitting has been studied in the RHIC accelerator. A correction system has been developed for correcting this large tune splitting which uses two families of skew quadrupole correctors. It has been found that this correction system corrects most of the large tune splitting, but a residual tune splitting remains that is still appreciable. RHIC has to operate within a box in tune space whose width is $\Delta\nu = 33 \times 10^{-3}$ in order to avoid all resonances which are tenth order or less. It appears desirable to correct the tune splitting to a level which is much smaller than 33×10^{-3}. The residual tune splitting that remained after correction with the 2 family tune splitting correction system was found to be about 18×10^{-3}. The residual tune splitting appears to be due to higher order effects of the random a_1 multipole. Loosely speaking, one may say that residual tune splitting is associated with the nearby linear sum resonance, $\nu_x + \nu_y$ = integer. A skew quadrupole correction system has been developed that appears able to correct a large part of the residual tune splitting. This consists of skew quadrupole correctors near the high-β quadrupoles in the insertions, which are excited so as to generate the harmonics that would drive the nearby sum resonances, $\nu_x + \nu_y$ = integer.

53495 (BNL–45269) **Intrabeam scattering and the beam lifetime.** Wei, J.; Ruggiero, A.G. Brookhaven National Lab., Upton, NY (USA). Sep 1990. 21p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. Order Number DE91001133. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The Fokker-Planck equation is derived to describe the time evolution of the longitudinal density distribution of a bunched hadron beam in the presence of intrabeam scattering. A computer program has been developed to numerically solve this equation. Both the beam loss and bunch-shape evolution are investigated for the $^{197}Au^{79+}$ beams during the 10-hour storage in the proposed RHIC collider. 14 refs.

53496 (CNIC–00245) **Spline function representation for transformation of phase space with arbitrary contours.** Mao Naifeng (Academia Sinica, Beijing, BJ (China). Inst. of Atomic Energy); Li Zenghai. China Nuclear Information Centre, Beijing, BJ (China). 1988. 6p. (In Chinese). (IAE–0057). Order Number DE91605959. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

In order to study the transport of beams with arbitrary phase space contours, the spline function representation of phase space contours is proposed. Having fitted the phase space contours with spline functions, phase space transformations are reduced to spline function transformations, and the envelopes of beams can be expressed by spline functions. Some typical examples are presented to illustrate the usefulness of this method.

53497 (CNIC-I–004, pp. 74-75) **Secondary beam optics calculation of HIRFL.** Feng Jun; Shen Wenqing; Yin Qunming; Zhan Wenlong; Wang Bin; Zhu Yongtai; Feng Enpu. China Nuclear Information Centre, Beijing, BJ (China); Academia Sinica, Lanzhou, GS (China). Inst. of Modern Physics. Jun 1990. In *IMP annual report, 1988 (January-December).* 138p. Order Number DE91606195. Source: NTIS (US Sales Only), PC A07/MF A01; OSTI; INIS.

Published in summary form only. BEAM OPTICS/hirfl cyclotron; BEAM OPTICS/secondary beams; BEAM PROFILES; BEAM TRANSPORT; COMPUTER CALCULATIONS; MATRICES; TIME-OF-FLIGHT METHOD

53498 (CNIC-I–004, pp. 100-102) **First trial for beam acceleration in HIRFL SSC.** China Nuclear Information Centre, Beijing,

BJ (China); Academia Sinica, Lanzhou, GS (China). Inst. of Modern Physics. Jun 1990. In *IMP annual report, 1988 (January-December)*. 138p. Order Number DE91606195. Source: NTIS (US Sales Only), PC A07/MF A01; OSTI; INIS.

Published in summary form only. BEAM CURRENTS/acceleration; HIRFL CYCLOTRON/performance testing; ACCELERATION; BEAM EXTRACTION; BEAM PROFILES; CARBON IONS; EXPERIMENTAL DATA; FARADAY CUPS; ORBITS

53499 (FNAL/C–90/174) **Feed-forward compensation for transient beam loading of the 805 MHz debuncher for the Fermilab linac upgrade.** MacLachlan, J.A.; Mills, F.E.; Owens, T. Fermi National Accelerator Lab., Batavia, IL (USA). 7 Sep 1990. 8p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH03000. (CONF-9009123–39: Linear accelerator conference, Albuquerque, NM (USA), 9-14 Sep 1990). Order Number DE91001544. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

The expected momentum spread from the 400 MeV upgrade of the Fermilab linac is ±0.19% growing to about ±0.25% in 63 m of beam transport to the booster synchrotron. The desired injection value is about ±0.05%. An 805 MHz (h=1) debuncher is located 47 m downstream of the linac to reduce the momentum spread and the differences in mean energy between bunches. The beam pulse to the booster will vary from about 2–15 μs at average current of 30–50 mA depending on program need. During 15 μs the beam excitation of the debuncher can reach 2.2 MV/m for a three-cell cavity. This gradient is comparable to, but 90° out of phase with, the 3.85 MV/m required to minimize the momentum spread. We choose to use feed-forward compensation to control the cavity field for the entire beam pulse. We discuss some general features of transient beam loading as well as the design and detailed simulation of the compensation scheme.

53500 (LA–11964-C) **Proceedings of the workshop on the science of intense radioactive ion beams.** McClelland, J.B.; Vieira, D.J. (comps.). Los Alamos National Lab., NM (USA). Oct 1990. 296p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-36. (CONF-9004209–: Workshop on the science of intense radioactive ion beams, Los Alamos, NM (USA), 10-12 Apr 1990). Order Number DE91000511. Source: NTIS, PC A14/MF A01; OSTI; INIS; GPO Dep.

This report contains the proceedings of a 2-1/2 day workshop on the Science of Intense Radioactive Ion Beams which was held at the Los Alamos National Laboratory on April 10–12, 1990. The workshop was attended by 105 people, representing 30 institutions from 10 countries. The thrust of the workshop was to develop the scientific opportunities which become possible with a new generation intense Radioactive Ion Beam (RIB) facility, currently being discussed within North America. The workshop was organized around five primary topics: (1) reaction physics; (2) nuclei far from stability/nuclear structure; (3) nuclear astrophysics; (4) atomic physics, material science, and applied research; and (5) facilities. Overview talks were presented on each of these topics, followed by 1-1/2 days of intense parallel working group sessions. The final half day of the workshop was devoted to the presentation and discussion of the working group summary reports, closing remarks and a discussion of future plans for this effort.

4303 Auxiliaries and Components

Refer also to citation(s) 53499, 53588, 54029, 54036

53501 (BNL–45170) **Electrical characteristics of a short RFQ resonator.** Ben-Zvi, I. (State Univ. of New York, Stony Brook, NY (USA). Dept. of Physics); Jain, A.; Wang, H.; Lombardi, A. Brookhaven National Lab., Upton, NY (USA). [1990]. 4p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. (CONF-9009123–38: Linear accelerator conference, Albuquerque, NM (USA), 9-14 Sep 1990). Order Number DE91001127. Source: NTIS, PC A01/MF A01; OSTI; INIS; GPO Dep.

Electrical characteristics of a short RFQ resonator of the "four rod" type have been studied by carrying out measurements on models and numerical simulations using the MAFIA codes. An empirical formula is obtained for the capacitance of vane-like electrodes in a four-rod RFQ resonator. It is shown that the electrode supports could account for a significant part of the total capacitance. This additional capacitance may change the circuit symmetry and give rise to a dipole component. This effect can be compensated by appropriate modifications of the support structure. The beam offset due to a dipole component is estimated. 6 refs., 4 figs., 1 tab.

53502 (CEA-N–2630) **The undulation of the Clio project.** Bourgeois, P.; Carlos, P.J.; Fallou, J.L.; Garganne, P.; Lepretre, A.; Martin, J.; Re, C. CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Physique Nucleaire. Feb 1990. 124p. (In French). Order Number DE91716253. Source: NTIS (US Sales Only), PC A06/MF A01.

The purpose of the CLIO project is to make a free electron laser (FEL) using a room temperature linear accelerator (RF). The laser beam will be tunable from 2 μm up to 20 μm, with a peak power greater than 10 MW and a mean power greater than 10 W. In this paper we present the study and the construction of the FEL undulator: choice of its main characteristics (period, length, gap...), computations of gain and efficiency, magnetic field measurements and finally electron trajectory and spontaneous radiation calculations together with results obtained from a Monte Carlo simulation of the electron beam.

53503 (CERN–90-07) **CAS CERN Accelerator School: Power converters for particle accelerators.** Turner, S. (ed.). European Organization for Nuclear Research, Geneva (Switzerland). 23 Jul 1990. 394p. (CONF-9003220–: Course on power converters for particle accelerators, Montreux (Switzerland), 26-30 Mar 1990). Order Number DE91605970. Source: NTIS (US Sales Only), PC A17/MF A01; OSTI; INIS.

This volume presents the proceedings of the fifth specialized course organized by the CERN Accelerator School, the subject on this occasion being power converters for particle accelerators. The course started with lectures on the classification and topologies of converters and on the guidelines for achieving high performance. It then went on to cover the more detailed aspects of feedback theory, simulation, measurements, components, remote control, fault diagnosis and equipment protection as well as systems and grid-related problems. The important topics of converter specification, procurement contract management and the likely future developments in semiconductor components were also covered. Although the course was principally directed towards DC and slow-pulsed supplies, lectures were added on fast converters and resonant excitation. Finally the programme was rounded off with three seminars on the related fields of Tokamak converters, battery energy storage for electric vehicles, and the control of shaft generators in ships. (orig.).

53504 (CNIC-I–004, pp. 2-3) **Dummy dee for the 1.7 m SFC.** He Shijian. China Nuclear Information Centre, Beijing, BJ (China); Academia Sinica, Lanzhou, GS (China). Inst. of Modern Physics. Jun 1990. In *IMP annual report, 1988 (January-December)*. 138p. Order Number DE91606195. Source: NTIS (US Sales Only), PC A07/MF A01; OSTI; INIS.

Published in summary form only. HIRFL CYCLOTRON/dees; HIRFL CYCLOTRON/ion sources; ACCELERATOR FACILITIES; CHINA; DIAGRAMS; DEES; VACUUM SYSTEMS

53505 (CNIC-I–004, pp. 5-6) **Operation and applications of the 200 KV ion implantor.** Xiao Zongli; Zhao Limin; Wang Jingyan; Fu Baojun; He Yusheng; Xiao Rongqing. China Nuclear Information Centre, Beijing, BJ (China); Academia Sinica, Lanzhou, GS (China). Inst. of Modern Physics. Jun 1990. In *IMP annual report, 1988 (January-December)*. 138p. Order Number DE91606195. Source: NTIS (US Sales Only), PC A07/MF A01; OSTI; INIS.

Published in summary form only. ION IMPLANTATION/ion sources; ION SOURCES/construction; ACCELERATORS; CONSTRUCTION; ION SPECTROSCOPY; OPERATION; PHYSICAL RADIATION EFFECTS; USES

53506 (CNIC-I–004, pp. 102-104) **Design of the HIRFL 800 new cryo-pump.** Zhang Shuxiu. China Nuclear Information Centre, Beijing, BJ (China); Academia Sinica, Lanzhou, GS (China). Inst. of Modern Physics. Jun 1990. In *IMP annual report, 1988*

(January-December). 138p. Order Number DE91606195. Source: NTIS (US Sales Only), PC A07/MF A01; OSTI; INIS.

Published in summary form only. CRYOPUMPS/specifications; HIRFL CYCLOTRON/cryopumps; BAFFLES; CRYOPUMPS; SPECIFICATIONS; HEAT TRANSFER; REFRIGERATORS; TEMPERATURE MONITORING

53507 (CNIC-I–004, pp. 104-105) **A 10 KW RF power amplifier for the buncher of HIRFL.** Gao Xiulin; Yin Zukang; Zhong Jie; Ma Xiaoming. China Nuclear Information Centre, Beijing, BJ (China); Academia Sinica, Lanzhou, GS (China). Inst. of Modern Physics. Jun 1990. In *IMP annual report, 1988 (January-December)*. 138p. Order Number DE91606195. Source: NTIS (US Sales Only), PC A07/MF A01; OSTI; INIS.

Published in summary form only. HIRFL CYCLOTRON/beam bunchers; POWER AMPLIFIERS/rf systems; ELECTRONIC CIRCUITS; MHZ RANGE 01-100

53508 (CNIC-I–004, pp. 106) **Power supply for the electrostatic deflector.** Zhou Wenmin. China Nuclear Information Centre, Beijing, BJ (China); Academia Sinica, Lanzhou, GS (China). Inst. of Modern Physics. Jun 1990. In *IMP annual report, 1988 (January-December)*. 138p. Order Number DE91606195. Source: NTIS (US Sales Only), PC A07/MF A01; OSTI; INIS.

Published in summary form only. POWER SUPPLIES/specifications; EFFICIENCY; ELECTRIC CONDUCTIVITY; ELECTRONIC CIRCUITS; ELECTROSTATIC ANALYZERS; HIRFL CYCLOTRON; KHZ RANGE 01-100; PERFORMANCE; SPECIFICATIONS

53509 (CNIC-I–004, pp. 107-108) **Display and control devices and data transportation on the center console.** Wang Zhen. China Nuclear Information Centre, Beijing, BJ (China); Academia Sinica, Lanzhou, GS (China). Inst. of Modern Physics. Jun 1990. In *IMP annual report, 1988 (January-December)*. 138p. Order Number DE91606195. Source: NTIS (US Sales Only), PC A07/MF A01; OSTI; INIS.

Published in summary form only. CONSOLES/data transmission systems; CONSOLES/display devices; HIRFL CYCLOTRON/consoles; HIRFL CYCLOTRON/control systems; COMPUTERS; CONSOLES; CONTROL EQUIPMENT

53510 (CNIC-I–004, pp. 108) **The magnetic field measurement of the bending magnets for the transport beam line of SFC-SSC.** Liu Dicheng; Wang Zhaolan; Zhang Guanghua; Feng Haiyan; Zhang Gongxiang; Jiang Houde; Zhou Jingxi; Yao Qingrong. China Nuclear Information Centre, Beijing, BJ (China); Academia Sinica, Lanzhou, GS (China). Inst. of Modern Physics. Jun 1990. In *IMP annual report, 1988 (January-December)*. 138p. Order Number DE91606195. Source: NTIS (US Sales Only), PC A07/MF A01; OSTI; INIS.

Published in summary form only. BEAM BENDING MAGNETS/magnetic fields; HIRFL CYCLOTRON/beam transport; APERTURES; DISTRIBUTION; PERFORMANCE TESTING

53511 (CNIC-I–004, pp. 108-109) **Magnetic measurement for HIRFL beam line quadrupole magnets and steering magnets.** Wang Zhaolan; Liu Dicheng; Zhang Guanghua; Feng Haiyan; Zhang Gongxiang; Jiang Houde; Yin Quanmin; ZHou Jingxi. China Nuclear Information Centre, Beijing, BJ (China); Academia Sinica, Lanzhou, GS (China). Inst. of Modern Physics. Jun 1990. In *IMP annual report, 1988 (January-December)*. 138p. Order Number DE91606195. Source: NTIS (US Sales Only), PC A07/MF A01; OSTI; INIS.

Published in summary form only. HIRFL CYCLOTRON/magnetic fields; MAGNETS/performance; BEAM TRANSPORT; HALL EFFECT; MAGNETS; PERFORMANCE; NONLINEAR PROBLEMS; QUADRUPOLES

53512 (CNIC-I–004, pp. 109-111) **The calibration of hall generators.** Zhou Jingxi; Rao Qingrong; Qiao Qingwen. China Nuclear Information Centre, Beijing, BJ (China); Academia Sinica, Lanzhou, GS (China). Inst. of Modern Physics. Jun 1990. In *IMP annual report, 1988 (January-December)*. 138p. Order Number DE91606195. Source: NTIS (US Sales Only), PC A07/MF A01; OSTI; INIS.

Published in summary form only. MHD GENERATORS/calibration; DISTRIBUTION; HALL EFFECT; HIRFL CYCLOTRON; LEAST SQUARE FIT; MAGNETIC FIELDS; MAGNETS; CALIBRATION

53513 (CONF-9010212–3) **Radiation effects on junction field-effect transistors (JFETS), MOSFETs, and bipolar transistors, as related to SSC circuit design.** Kennedy, E.J. (Tennessee Univ., Knoxville, TN (USA)); Alley, G.T.; Britton, C.L. Jr.; Skubic, P.L.; Gray, B.; Wu, A. Oak Ridge National Lab., TN (USA). [1990]. 7p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From Symposium on detector research and development for the superconducting super collider; Fort Worth, TX (USA); 15-18 Oct 1990. Order Number DE91001486. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

Some results of radiation effects on selected junction field-effect transistors, MOS field-effect transistors, and bipolar junction transistors are presented. The evaluations include dc parameters, as well as capacitive variations and noise evaluations. The tests are made at the low current and voltage levels (in particular, at currents ≤ 1 mA) that are essential for the low-power regimes required by SSC circuitry. Detailed noise data are presented both before and after 5-Mrad (gamma) total-dose exposure. SPICE radiation models for three high-frequency bipolar processes are compared for a typical charge-sensitive preamplifier.

53514 (CRN-PN–8920) **VIVITRON beam transport.** Nadji, A. Strasbourg-1 Univ., 67 (France). Centre de Recherches Nucleaires; Strasbourg-1 Univ., 67 (France). Jul 1989. 162p. (In French). Order Number DE91716290. Source: NTIS (US Sales Only), PC A08/MF A01.

The VIVITRON is a new 35 MV particle accelerator which presents a great number of innovations. One of the major problem is the beam transport in this electrostatic machine of 50 m length for ions with masses between 1 and 200. Our work consisted in the study of various experimental and theoretical aspects of the beam transport in Tandem accelerators from the ion source to the analysing magnet. Calculations of the beam optics were performed with a Strasbourg version of the computer code Transport. They allowed us to optimize the beam transport parameters of the VIVITRON elements. Special attention has been focused on the design of the charge state selector to be installed in the terminal of the new machine. Beam transmission measurements were carried out in the Strasbourg MP 10 Tandem accelerator for ions beams of masses between 1 and 127 and for terminal voltages from 9 to 15 MV. Partial and total transmissions were obtained and explanations of the beam losses were proposed in terms of the vacuum pressure and/or the optics of the beam accelerator system. The results have been extrapolated to the VIVITRON for which the best working conditions are now clearly defined.

53515 (GANIL-A–8907) **Production and acceleration of Ca-beams with the ECR source in the Jinr-Ganil experiment.** Lukyanov, S.M. (Joint Inst. for Nuclear Research, Dubna (SU)); Artukh, A.G.; Gvozdev, B.A.; Kutner, V.B.; Penionzhkevich, Y.E.; Bex, L.; Bourgarel, M.P.; Ferme, J. Grand Accelerateur National d'Ions Lourds (GANIL), 14 - Caen (France). 1989. 11p. Order Number DE91716321. Source: NTIS (US Sales Only), PC A03/MF A01.

The results of production and acceleration of ^{48}Ca-beams with the ECR-source are described. For this purpose a special technique has been developed which allows the metal to be extracted from the oxide with the aluminium as an acceptor. The mean rate of consumption of ^{48}Ca was about 2 mg/h and the beam intensity was about 15μA on charge state 6. The method for recuperation of used calcium is presented.

53516 (GANIL-A–8911) **Heavy ion losses by charge exchange in the Ganil cyclotrons.** Bajard, M.; Baron, E. Grand Accelerateur National d'Ions Lourds (GANIL), 14 - Caen (France). 1989. 16p. (CONF-8911247–: 26. European Cyclotron Progress Meeting, Louvain-la-Neuve (Belgium), 22-25 Nov 1989). Order Number DE91716315. Source: NTIS (US Sales Only), PC A03/MF A01.

Investigations were made on the dependence of the heavy ion beam transmission on the internal pressure of the injector and of the first separated sector cyclotron at GANIL. The following ion

species were studied: 6.4 Mev/u Xe^{17+} and 4.9 MeV/u Ta^{20+} in CSS1 and 0.5 MeV/u Xe^{18+} and 0.3 MeV/u Pb^{23+} in the injector. An attempt is made to compare the results with predictions based on the Betz and Schmelzer [1] formulas giving the charge exchange cross-sections.

53517 (KEK–89-21, pp. 151-156) **Status report on JAERI activities.** Takeuchi, Suehiro (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Jan 1990. (CONF-8908239–: 4. workshop on RF superconductivity, Tsukuba (Japan), 14-18 Aug 1989). In *Proceedings of the 4th workshop on RF superconductivity.* 910p. Order Number DE90508149. Source: NTIS (US Sales Only), PC A99/MF A01.

There are three kinds of activities related to rf superconductivity in JAERI; a construction project of a superconducting heavy ion booster, a research program of metal-oxide superconducting cavities and a research project of a free electron laser. This paper describes the outline of these activities. (author).

53518 (KEK–89-21, pp. 157-166) **Rf superconductivity research and development at Los Alamos National Laboratory.** Cooke, D.W. (Los Alamos National Lab., NM (USA)); Gray, E.R.; Houlton, R.J.; Lawrence, G.P.; McGill, J.A.; Meyer, E.; Morris, C.; Rusnak, B.; Starke, T.P. National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Jan 1990. (CONF-8908239–: 4. workshop on RF superconductivity, Tsukuba (Japan), 14-18 Aug 1989). In *Proceedings of the 4th workshop on RF superconductivity.* 910p. Order Number DE90508149. Source: NTIS (US Sales Only), PC A99/MF A01.

Los Alamos National Laboratory is engaged in two distinct areas of rf superconductivity research and development. One program is devoted to studying the rf properties of high-temperature superconductors (HTS) and assessing their potential for accelerator-cavity applications. Our best results to date have come from $YBa_2Cu_3O_7$ films (0.8 μm) electron-beam deposited onto $LaGaO_3$ substrates. A typical surface resistance value is 0.2 $\pm$ 0.1 mΩ measured at 22 GHz and 4 K, which is only a factor of 2 - 4 higher than Nb. A second area of rf superconductivity R and D at Los Alamos involves fabricating and testing conventional Nb superconducting rf cavities. Facilities are being constructed for polishing, cleaning, and testing both small (3-GHz) and large (805-MHz) Nb cavities. Much of our effort is being devoted to understanding the proper techniques for welding, cleaning, and handling Nb cavities, to ensure good high-field performance. Nb cavity applications are foreseen in upgrades to LAMPF, compact free-electron lasers, and high-current cw proton linacs. A single 402.5-MHz Nb cavity (in a beam cryostat) is presently being acquired from industry to provide a momentum compactor for the low-energy pion beam at LAMPF. (author).

53519 (KEK–89-21, pp. 175-188) **Status report on the Saclay Heavy Ion Superconducting Linac.** Cauvin, B. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Inst. de Recherche Fondamentale (IRF)); Fouan, J.P. National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Jan 1990. (CONF-8908239–: 4. workshop on RF superconductivity, Tsukuba (Japan), 14-18 Aug 1989). In *Proceedings of the 4th workshop on RF superconductivity.* 910p. Order Number DE90508149. Source: NTIS (US Sales Only), PC A99/MF A01.

The Saclay Heavy Ion Superconducting Linac is now in full operation with all 50 resonators and delivers routinely beams to Nuclear and Solid State Physics experiments since March 1989. After describing the LINAC, we give informations on the upgrading of the cryogenic system and summarize our experience of resonator behaviour on the accelerating line. Cooldown, multipactor barrier conditioning, and field raising procedures are also discussed. (author).

53520 (KEK–89-21, pp. 351-376) **High power couplers.** Dwersteg, B. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Jan 1990. (CONF-8908239–: 4. workshop on RF superconductivity, Tsukuba (Japan), 14-18 Aug 1989). In *Proceedings of the 4th workshop on RF superconductivity.* 910p. Order Number DE90508149. Source: NTIS (US Sales Only), PC A99/MF A01.

The break of a high power input window is the most likely and dangerous accident for SC cavity systems. This is a motivation to compare and evaluate different designs and operating experiences and limitations of high power couplers for superconducting as well as normal conducting cavities. Equivalent information of klystron windows will be included for comparison. (author).

53521 (KEK–89-21, pp. 427-436) **Prototype niobium resonators for high-current ion beams.** Delayen, J.R. (Argonne National Lab., IL (USA)); Bohn, C.L. National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Jan 1990. (CONF-8908239–: 4. workshop on RF superconductivity, Tsukuba (Japan), 14-18 Aug 1989). In *Proceedings of the 4th workshop on RF superconductivity.* 910p. Order Number DE90508149. Source: NTIS (US Sales Only), PC A99/MF A01.

We are developing and constructing a series of niobium resonators for the acceleration of high-current ion beams. These structures are designed to operate at frequencies of 350 MHz to over 1 GHz and velocities of 0.1 c to 0.5 c. Both coaxial quarter-wave and coaxial half-wave geometries are being explored. By comparing quarter-wave and half-wave structures of the same frequency and velocity, we plan to quantify the relative performance of these two distinct geometries. (author).

53522 (KEK–89-21, pp. 437-443) **Results of postpurified 3 GHz accelerator structures.** Roeth, R.W. (Wuppertal Univ. (Gesamthochschule) (Germany, F.R.)); Heinrichs, H.; Mueller, G.; Piel, H.; Pouryamout, J. National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Jan 1990. (CONF-8908239–: 4. workshop on RF superconductivity, Tsukuba (Japan), 14-18 Aug 1989). In *Proceedings of the 4th workshop on RF superconductivity.* 910p. Order Number DE90508149. Source: NTIS (US Sales Only), PC A99/MF A01.

In order to improve the performance of the 3 GHz superconducting accelerator structures for the Darmstadt Recyclotron, we have applied high temperature annealing at 1300degC and at 1350degC under exposure to titanium vapor to single cell cavities as well as to five and twenty cell structures fabricated from 2 mm reactor grade and medium purity Nb sheet metal. The achieved accelerating fields reproducibly increased in case of a single cell cavity from about 8 to 27 MV/m, in case of a 5-cell structure from about 5 to 13 MV/m, and in case of a 20-cell structure typically from about 4 to 8 MV/m. The fields were limited by thermal instability (quench), only when rinsing in demineralized water was the final treatment field emission was the limiting phenomenon. It has been demonstrated that purification by exposing only the outside of the structure to titanium vapor gives a good or even better results than purification from inside and outside. This technique has moreover the advantage that there is no frequency shift due to a subsequent chemical polishing. (author).

53523 (KEK–89-21, pp. 477-499) **Manufacturing and testing of the first four superconducting Nb cavities for LEP.** Bloess, D. (European Organization for Nuclear Research, Geneva (Switzerland)); Cavallari, G.; Chiaveri, E.; Gorin, I.; Stierlin, R.; Tueckmantel, J.; Weingarten, W. National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Jan 1990. (CONF-8908239–: 4. workshop on RF superconductivity, Tsukuba (Japan), 14-18 Aug 1989). In *Proceedings of the 4th workshop on RF superconductivity.* 910p. Order Number DE90508149. Source: NTIS (US Sales Only), PC A99/MF A01.

An approach towards industrial fabrication of superconducting Nb cavities for LEP was undertaken and the experience is described. Out of the first four Nb superconducting cavities to be installed in LEP two cryostats and cavities were produced by CERN and two more by industry. The results are essentially the same. The accelerating field and Q-value at the design value are between 5.3 and 9 MV/m and between 2.0 and 3.3 x 10^9, respectively. The static cryostat losses were 16 W. The ancillary equipment (couplers, tuners) was produced by CERN. All the fabrication sequence applied at CERN has been used in an identical way by industry. (author).

53524 (KEK–89-21, pp. 621-633) **HOM couplers for a 1 mA linac FEL driver.** Baron, A. (Stanford Univ., CA (USA). High-Energy Physics Lab.); Haebel, E. National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Jan 1990. (CONF-8908239–: 4.

workshop on RF superconductivity, Tsukuba (Japan), 14-18 Aug 1989). In *Proceedings of the 4th workshop on RF superconductivity*. 910p. Order Number DE90508149. Source: NTIS (US Sales Only), PC A99/MF A01.

HOM couplers have been designed for a 1 mA linac FEL driver with beam recirculation capability. The linac consists of 4-cell structures resonant at 1.3 GHz. CERN's widened beamtube concept with multimode endcell compensation has been adopted in its DESY version together with a coaxial coupler geometry to obtain compactness and low cost. Because it is easily tuned and cooled and is particularly short, CERN's one post coupler has been selected and adapted for use at 1.3 GHz. With optimized geometry the transfer curve is composed of two suitably placed low Q resonances and only one parasitic notch of 8 dB depth located above 4 GHz. There the fundamental mode monitor probes, which have been given a strongly enhanced high frequency coupling characteristic provide adequate cavity damping. (author).

53525 (KEK–89-21, pp. 773-779) **Thermal performance of A' cryounit.** Schneider, W. (Continuous Electron Beam Accelerator Facility, Newport News, VA (USA)); Campisi, I.; Mann, T.; Robb, J.; Sundelin, R. National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Jan 1990. (CONF-8908239–: 4. workshop on RF superconductivity, Tsukuba (Japan), 14-18 Aug 1989). In *Proceedings of the 4th workshop on RF superconductivity*. 910p. Order Number DE90508149. Source: NTIS (US Sales Only), PC A99/MF A01.

CEBAF, an electron accelerator under construction in Virginia, has 338 superconducting RF cavities contained in 42 1/4 cryomodules. Four cryounits which house eight RF cavities and a set of end caps make up a cryomodule. The thermal performance of a prototypical cryounit and end cap set is presented. (author).

53526 (RCNP-T–28) **Proceedings of the RCNP cyclotron cascade workshop on polarized ion sources and gas jets for nuclear physics at an intermediate energy.** Osaka Univ., Ibaraki (Japan). Research Center for Nuclear Physics. Feb 1990. 230p. (CONF-900289–: RCNP cyclotron cascade workshop on polarized ion sources and gas jets for nuclear physics at an intermediate energy, Tsukuba-Shi (Japan), 12-17 Feb 1990). Order Number DE91712928. Source: NTIS (US Sales Only), PC A11/MF A01.

The present workshop aimed at active and informal discussion on the present status and the perspective of the polarized ion sources, polarized gas jets and possible physics with them from both the experimental and theoretical viewpoints in particular paying attention to nuclear physics at an intermediate energy region. Polarization studies in nuclear physics have provided us many fruitful results regarding both the nuclear structure and nuclear reaction mechanism. The RCNP isochronous cyclotron facility has also played an important role in this field with polarized proton and deuteron beams. In addition, the delivery of the first beam from the RCNP ring cyclotron with K = 400 MeV is scheduled in the next year. It was quite timely to discuss the technology in polarized ion sources and polarized gas jets and the polarization phenomena at an intermediate energy region. We believe that the excellent results obtained through this workshop may hopefully shed a light upon our future direction toward nuclear physics at the intermediate energy region. This volume is compiled based on copies of transparencies presented by each speaker. (J.P.N.).

53527 (SLAC-PUB–5293) **Software management issues.** Kunz, P.F. Stanford Linear Accelerator Center, Menlo Park, CA (USA). Jun 1990. 7p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00515. (CONF-890415–14: International conference on computing in high energy physics, Oxford (UK), 10-14 Apr 1989). Order Number DE91001031. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

The difficulty of managing the software in large HEP collaborations appears to becoming progressively worst with each new generation of detector. If one were to extrapolate to the SSC, it will become a major problem. This paper explores the possible causes of the difficulty and makes suggestions on what corrective actions should be taken.

53528 (SLAC-PUB–5320) **Progress report on high-gradient RF studies in copper accelerator structures.** Loew, G.A.; Wang, J.W. Stanford Linear Accelerator Center, Menlo Park, CA (USA). Sep 1990. 3p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00515. (CONF-9009192–15: International symposium on discharges and electrical insulation in vacuum, Santa Fe, NM (USA), 17-20 Sep 1990). Order Number DE91001029. Source: NTIS, PC A01/MF A01; OSTI; INIS; GPO Dep.

This paper is a progress report on studies carried out at the Stanford Linear Accelerator Center to understand the behavior of copper accelerator structures under extremely high RF fields. Such structures are being designed for future electron-positron linear colliders. Recent studies include field emission and breakdown experiments with an S-band slotted-disk structure, a single demountable S-band cavity and a short X-band structure which has not yet been tested. The demountable cavity was built specifically to examine the effects of copper quality, surface conditioning, gaseous exposures, and surface damage. Results to date and recent theoretical conjectures are discussed.

53529 (SLAC-PUB–5321) **HEM_{11} modes revisited.** Wang, J.W.; Loew, G.A. Stanford Linear Accelerator Center, Menlo Park, CA (USA). Sep 1990. 4p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00515. (CONF-9009123–37: Linear accelerator conference, Albuquerque, NM (USA), 9-14 Sep 1990). Order Number DE91001028. Source: NTIS, PC A01/MF A01; OSTI; INIS; GPO Dep.

Concern with emittance growth in future multi-bunch linear colliders has rekindled interest in HEM_{11} dipole modes (sometimes also called "TM_{11}-like" or "TE_{11}-like") in disk-loaded waveguides. The availability of modern computer codes (URMEL, MAFIA) makes it possible to gain a deeper understanding of these modes and their properties. This paper presents ω-β dispersion diagrams, field configurations and transverse shunt impedances for the HEM_{11} modes as a function of iris aperture. The transition between forward and backward waves of the various branches is explored. This information serves as background material for another paper at this conference which reports recent work on linac structures in which these modes are damped or detuned. 5 refs., 3 figs., 1 tab.

53530 (SLAC-PUB–5322) **Damped and detuned accelerator structures.** Deruyter, H.; Farkas, Z.D; Hoag, H.A.; Ko, K.; Kroll, N.; Loew, G.A.; Miller, R.; Palmer, R.B.; Paterson, J.M.; Thompson, K.A.; Wang, J.W.; Wilson, P.B. Stanford Linear Accelerator Center, Menlo Park, CA (USA). Sep 1990. 3p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00515. (CONF-9009123–36: Linear accelerator conference, Albuquerque, NM (USA), 9-14 Sep 1990). Order Number DE91001027. Source: NTIS, PC A01/MF A01; OSTI; INIS; GPO Dep.

This paper reports continuing work on accelerator structures for future TeV linear colliders. These structures, in addition to having to operate at high gradients, must minimize the effects of wakefield modes which are induced by $e^{\pm}$ bunch trains. Two types of modified disk-loaded waveguides are under investigation: damped structures in which the wakefield power is coupled out to lossy regions through radial slots in the disks and/or azimuthal rectangular waveguides, whereby the external Q of the undesirable HEM_{11} mode is lowered to values below 20, and detuned structures in which the frequencies of these modes are modified from one end to the other of each section by ~10%, thereby scrambling their effects on the beam. Beam dynamics calculations indicate that these two approaches are roughly equivalent. MAFIA, ARGUS and URMEL codes have been used extensively in conjunction with low-power tests on S- and X-band models to identify mode patterns, dispersion curves and Q values, and to demonstrate damping or detuning of the HEM modes. Results of calculations and measurements on the various structures are presented and evaluated.

53531 (SLAC-PUB–5325) **High gradient electron guns.** Fant, K.S. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)); Caryotakis, G.; Koontz, R.F.; Vlieks, A.E.; Miram, G. Stanford Linear Accelerator Center, Menlo Park, CA (USA). Aug 1990. 2p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00515. (CONF-9009192–14: International symposium on discharges and electrical insulation in vacuum, Santa Fe, NM (USA), 17-20 Sep 1990). Order Number DE91000056. Source: NTIS, PC A01/MF A01 - OSTI; GPO Dep.

Experiments have been conducted to determine peak operating gradients attainable in thermionic electron guns. These tests are part of a study of high-current-density, long-life cathodes suitable for use in high power klystrons. We also investigated the use of chromium oxide coating as a means of inhibiting electronic breakdown across the focus electrode anode gap. Field gradients in excess of 280 kV/cm have been achieved for a gun operating at 240 kV with a beam current of 228 A, at pulse widths of the order of 1 μs. 3 refs., 5 figs.

53532 (UCRL-JC-103798) **Relativistic klystron simulations using RKTW2D.** Ryne, R.D.; Yu, S.S. Lawrence Livermore National Lab., CA (USA). 19 Sep 1990. 5p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-9009123-40: Linear accelerator conference, Albuquerque, NM (USA), 9-14 Sep 1990). Order Number DE91001747. Source: NTIS, PC A01/MF A01 - OSTI; GPO Dep.

We are developing a two-dimensional, time-dependent computer code for the simulation of relativistic klystrons. We will discuss the main features of our code. We will also present an example simulation of a relativistic klystron with both a standing wave output cavity and a traveling wave output structure.

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Refer also to citation(s) 53562, 54000, 54001

53533 (KEK-89-21, pp. 65-73) **RF superconductivity at DESY.** Dwersteg, B. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)); Friesen, T.; Koerber, W.; Matheisen, A.; Moeller, W.-D.; Proch, D.; Renken, D.; Sekutowicz, J. National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Jan 1990. (CONF-8908239-: 4. workshop on RF superconductivity, Tsukuba (Japan), 14-18 Aug 1989). In *Proceedings of the 4th workshop on RF superconductivity.* 910p. Order Number DE90508149. Source: NTIS (US Sales Only), PC A99/MF A01.

After the successful prototype program 16 superconducting cavities including the necessary cryostats, RF- and cryogenic infrastructure are under industrial production. The whole system will be installed in HERA before summer 1990 to increase the e^- energy up to 33.5 GeV. We report about the status of these activities as well as about parallel research on superconductivity (pipe cooling, Nb- sputtered Cu-cavities and HTc-RF measurements). (author).

53534 (KEK-89-21, pp. 593-604) **SC-cavity operation via WG-transformer.** Dwersteg, B. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Jan 1990. (CONF-8908239-: 4. workshop on RF superconductivity, Tsukuba (Japan), 14-18 Aug 1989). In *Proceedings of the 4th workshop on RF superconductivity.* 910p. Order Number DE90508149. Source: NTIS (US Sales Only), PC A99/MF A01.

Varying beam currents in storage rings like PETRA and HERA strongly change the match condition of the generator-cavity system. To maintain optimum energy transfer variable input coupling is needed. A variable waveguide transformer was developed which covers transformation ratios of 0.2 to 5. Additionally this device allows to change the cavity phase independently. The parameters of a system consisting of generator, transformer and superconducting cavity under operation in a storage ring will be discussed. (author).

53535 (KEK-89-21, pp. 635-694) **R and D of superconducting cavities at KEK.** Saito, Kenji (National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan)); Kojima, Yuzo; Furuya, Takaaki. National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Jan 1990. (CONF-8908239-: 4. workshop on RF superconductivity, Tsukuba (Japan), 14-18 Aug 1989). In *Proceedings of the 4th workshop on RF superconductivity.* 910p. Order Number DE90508149. Source: NTIS (US Sales Only), PC A99/MF A01.

We completed vertical tests of the TRISTAN scc during this spring, 1989. An accelerating field of 9.6 MV/m, Qo at 5 MV/m of 2.8×10^9 (on average) was obtained during these tests. Thus, a technical background has been established for scc large-scale applications to accelerators. In this paper, the R and D of surface treatment and niobium material at KEK is described, especially regarding the type of problems encountered and how they could be solved. Our technical level regarding large-scale scc production is also discussed. (author).

53536 (KEK-89-21, pp. 755-763) **Cryogenic system for TRISTAN superconducting RF cavity.** Hosoyama, K. (National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan)); Hara, K.; Kabe, A.; Kojima, Yuuji; Ogitsu, T.; Sakamoto, Y.; Kawamura, S.; Ishimaru, Y. National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Jan 1990. (CONF-8908239-: 4. workshop on RF superconductivity, Tsukuba (Japan), 14-18 Aug 1989). In *Proceedings of the 4th workshop on RF superconductivity.* 910p. Order Number DE90508149. Source: NTIS (US Sales Only), PC A99/MF A01.

A cryogenic system consisting of a helium refrigerator (4 kW at 4.4 K) and a liquid helium distribution transfer system for TRISTAN 508 MHz 32 x 5-cell superconducting RF cavities was designed and constructed. After the performance test of the cryogenic system, 16 x 5-cell superconducting RF cavities in 8 cryostats were installed in underground TRISTAN electron-positron collider and connected to the helium refrigerator on the ground level through the transfer line (total length about 330 m) and cooled by liquid helium pool boiling in parallel. The cryogenic system and its operation experience are described. (author).

53537 (KEK-89-21, pp. 765-771) **Cryogenic system for SCC horizontal test.** Ogitsu, T. (National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan)); Ajima, Y.; Hara, K.; Hosoyama, K.; Kabe, A.; Kojima, Yuuji; Sakamoto, Y.; Terashima, A. National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Jan 1990. (CONF-8908239-: 4. workshop on RF superconductivity, Tsukuba (Japan), 14-18 Aug 1989). In *Proceedings of the 4th workshop on RF superconductivity.* 910p. Order Number DE90508149. Source: NTIS (US Sales Only), PC A99/MF A01.

A cryogenic system for testing Superconducting RF cavity (SCC) in horizontal cryostat has been constructed. Thirty-two 5-cell SCC in 16 cryostat for TRISTAN electron positron collider have been tested at the test stand which consist of refrigerator/liquifier (BOC Turbo Cool 100: 300W/110litter/hr), 1000litter L.He dewar, and transfer lines. In the horizontal test we have comfirmed cryostat performance and cavity performance on low and high RF power. First horizontal test has been started in December 1987 and last one has been finished in July 1989. During this duration this system has achieved 23 times of horizontal test and has liquified He for vertical test. And finally all of SCC have successfully prepared for installation. Present equipment status and its operation experience of horizontal test will be reported. (author).

53538 (KEK-89-21, pp. 781-803) **Pressure protection against vacuum failures on the cryostats for LEP sc cavities.** Cavallari, G. (European Organization for Nuclear Research, Geneva (Switzerland)); Guesewell, D.; Stierlin, R.; Gorine, I. National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Jan 1990. (CONF-8908239-: 4. workshop on RF superconductivity, Tsukuba (Japan), 14-18 Aug 1989). In *Proceedings of the 4th workshop on RF superconductivity.* 910p. Order Number DE90508149. Source: NTIS (US Sales Only), PC A99/MF A01.

Three types of moderate vacuum failure were studied experimentally on a prototype of the sc cavity cryostats developed for LEP. The observations were interpreted using a simplified description of the liquid helium (LHe) bath and extrapolated to the worst possible pressure rise. This was verified in a last test by breaking the cavity vacuum in a fraction of a second with an 80 mm diameter valve. It was concluded that this simulated indeed the worst case and that, as a minimum, a rupture disk of 20 cm^2 is required on a low-impedance safety pipe to exclude excessive peak pressures and damage to the cavity. (author).

53539 (KEK-89-21, pp. 805-819) **Cryostat for TRISTAN superconducting cavity.** Mitsunobu, S. (National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan)); Furuya, T.; Hara, K. National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Jan 1990. (CONF-8908239-: 4. workshop on RF superconductivity, Tsukuba (Japan), 14-18 Aug 1989). In *Proceedings of the 4th workshop on RF superconductivity.* 910p. Order Number DE90508149. Source: NTIS (US Sales Only), PC A99/MF A01.

Superconducting cavities generate rather high heat load of hundreds watts in one cryostat and have high sensitivity for pressure. We adopted usual pool-boiling type cooling for its stable pressure operation. Two 5-cell Nb cavities were installed in one flange type cryostat. Tuning mechanics actuated by a pulse-motor and a Piezo-electric element are set at outside of vacuum end flange. The design and performance of the cryostat for TRISTAN superconducting cavities are described. (author).

53540 (KEK–89-21, pp. 821-847) **Pre-tuning of TRISTAN superconducting RF cavities.** Tajima, Tsuyoshi (National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan)); Furuya, Takaaki; Suzuki, Toshiji; Iino, Yohsuke. National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Jan 1990. (CONF-8908239–: 4. workshop on RF superconductivity, Tsukuba (Japan), 14-18 Aug 1989). In *Proceedings of the 4th workshop on RF superconductivity.* 910p. Order Number DE90508149. Source: NTIS (US Sales Only), PC A99/MF A01.

Pre-tuning of thirty-two TRISTAN superconducting cavities has been done. In this paper are described the pre-tuning system and the results of all the cavities. The average field flatness was 1.4 % after pre-tuning. From our experience, the following are important, (1) to evacuate the cavity during the process of the pre-tuning to avoid the uncertainty in evacuation, (2) pre-tuning is needed after annealing because it causes changes of the cell length and the field profile and (3) field flatness sometimes changes when expanded and (4) cells should not be expanded more than 1.5 mm after pre-tuning since inelastic deformation occurs. (author).

53541 (KEK–89-21, pp. 869-884) **Status report on CERN activities aiming at the production of sputter-coated copper superconducting RF cavities for LEP.** Benvenuti, C. (European Organization for Nuclear Research, Geneva (Switzerland)); Bloess, D.; Chiaveri, E.; Hilleret, N.; Minestrini, M.; Weingarten, W. National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Jan 1990. (CONF-8908239–: 4. workshop on RF superconductivity, Tsukuba (Japan), 14-18 Aug 1989). In *Proceedings of the 4th workshop on RF superconductivity.* 910p. Order Number DE90508149. Source: NTIS (US Sales Only), PC A99/MF A01.

To upgrade LEP energy above 55 GeV, the first step will consist in installing 32 SC cavities of 352 MHz frequency at Point 2 of the machine. This operation will be carried out in steps and should be completed by the end of 1991. It has been decided that 8 of the 32 cavities will be Nb coated copper cavities, the crucial part of which (i.e. the cavity proper) will be manufactured and coated at CERN. For the time being, 4 of these 8 cavities have been prepared. They present Q_0 values at low field of about 10^{10}, while at the specified operating field of 5 MV/m their Q_0 range between 5 and 7 x 10^9. In order to carry out assembly, coating and rinsing of cavities in better (i.e. cleaner) conditions, an experimental hall is being prepared, which will become operational after summer 1989, such as to be used for the manufacturing of the second batch of 4 coated cavities. In parallel with this main activity, some work is also being devoted to the study of coatings of higher T_c materials, namely NbTiN. Due to the higher T_c, these new coatings should present a lower BCS RF resistivity, a necessary condition to obtain higher Q_0 values. The first cavity coated so far with NbTiN (a single cell cavity of 500 MHz frequency) gave encouraging results, which however are not better than what was obtained with a Nb film. (author).

44 INSTRUMENTATION

53542 (CNIC-I–004, pp. 98) **Preliminary adjustment of software for MOLDAS II.** Yu Jusheng; Yin Xijin. China Nuclear Information Centre, Beijing, BJ (China); Academia Sinica, Lanzhou, GS (China). Inst. of Modern Physics. Jun 1990. In *IMP annual report, 1988 (January-December).* 138p. Order Number DE91606195. Source: NTIS (US Sales Only), PC A07/MF A01; OSTI; INIS.

Published in summary form only. COMPUTERS/performance testing; DATA ACQUISITION SYSTEMS/computers; COMPUTERS; DEFECTS; PROGRAMMING; SIMULATION

53543 (IFUSP-P–832) **Determination of the upper limit of a peak area.** Helene, O. Sao Paulo Univ., SP (Brazil). Inst. de Fisica. Mar 1990. 19p. Order Number DE91606081. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

This paper reports the procedure to extract an upper limit of a peak area in a multichannel spectrum. This procedure takes into account the finite shape of the peak and the uncertanties in the background and in the expected position of the peak. (author).

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Refer also to citation(s) 52904, 52936, 52978, 53329, 53702, 53990, 54002, 54003, 54004, 54005, 54006, 54010, 54102, 54125, 54174, 54195, 54282, 54289

53544 (BNL–45262) **Free ion yields for several silicon, germanium and tin containing liquids.** Holroyd, R.A. (Brookhaven National Lab., Upton, NY (USA)); Geer, S.; Ptohos, F. Brookhaven National Lab., Upton, NY (USA). [1990]. 3p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016 ;AC02-76ER03064. (CONF-9010212–1: Symposium on detector research and development for the superconducting super collider, Fort Worth, TX (USA), 15-18 Oct 1990). Order Number DE91001246. Source: NTIS, PC A01/MF A01; OSTI; INIS; GPO Dep.

A survey was made of compounds containing silicon, germanium or tin atoms to find new room temperature liquids for use in ionization chambers. The results show an interesting correlation of free ion yields with molecular structure. The data were also analyzed to obtain the average thermalization ranges of electrons formed in the ionization process.

53545 (CNIC–00311) **Data acquisition and processing based on the multi-microcomputers data communication system for the physics experiments of HL-1 tokamak.** Ren Libo (Academia Sinica, Lanzhou, GS (China). Inst. of Modern Physics); Liu Aiping; Xu Wenbin; Ao Xueling; Gao Lanbin; Yan Derong. China Nuclear Information Centre, Beijing, BJ (China). Aug 1989. 13p. (In Chinese). (SIP–0035). Order Number DE91606094. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

The data acquisition and processing system and automatic monitor system based on the data communication of multimicrocomputers for the physics experiments of HL-1 tokamak are described. The data communications between microcomputers are completed with parallel and serial interfaces. The signals from Rokofski coils, single loop turn, soft X-ray absorb spectrometer, microwave interfermeter, bolometer, soft X-ray sawtooth Au-Si surface barrier detectors and magnetic probes have been acquired and processed. Plasma parameters have been obtained. Specially, the electron density profiles have been obtained for the first time, and the simulation about plasma radius, horizontal displacement, electron temperature and electron line-average density has been completed.

53546 (CNIC-I–004, pp. 66) **A XRF system and its applications.** Yin Zhongli; Jiang Xinzhou; Zhang Shumin; Ma Chengjun; Liang Qiang. China Nuclear Information Centre, Beijing, BJ (China); Academia Sinica, Lanzhou, GS (China). Inst. of Modern Physics. Jun 1990. In *IMP annual report, 1988 (January-December).* 138p. Order Number DE91606195. Source: NTIS (US Sales Only), PC A07/MF A01; OSTI; INIS.

Published in summary form only. X-RAY FLUORESCENCE ANALYZERS/performance; X-RAY FLUORESCENCE ANALYZERS/uses; CHEMICAL ANALYSIS; ENERGY RESOLUTION; MULTICHANNEL ANALYZERS; PDP COMPUTERS; SHIELDING; STABILITY; TRACE AMOUNTS; PERFORMANCE; USES

53547 (CNIC-I–004, pp. 73) **A set-up for detection of residue at/near beam direction.** Liang Guozhao; Wang Dayan; Jin Genming; Dai Guangxi; Zhang Baoguo; Cai Wei; Qian Xing. China Nuclear Information Centre, Beijing, BJ (China); Academia Sinica, Lanzhou, GS (China). Inst. of Modern Physics. Jun 1990. In *IMP annual report, 1988 (January-December).* 138p. Order Number DE91606195. Source: NTIS (US Sales Only), PC A07/MF A01; OSTI; INIS.

Published in summary form only. LINEAR MOMENTUM TRANSFER/measuring instruments; BEAM CURRENTS; BEAM TRANSPORT; ELECTRODES; RESIDUES; TELESCOPE COUNTERS; TIME-OF-FLIGHT SPECTROMETERS

53548 (CNIC-I-004, pp. 83-84) **A special-shaped detector.** Zhao Rongpu; Li Cunfan; Wang Zhusheng. China Nuclear Information Centre, Beijing, BJ (China); Academia Sinica, Lanzhou, GS (China). Inst. of Modern Physics. Jun 1990. In *IMP annual report, 1988 (January-December).* 138p. Order Number DE91606195. Source: NTIS (US Sales Only), PC A07/MF A01; OSTI; INIS.

Published in summary form only. SURFACE BARRIER DETECTORS/gold; SURFACE BARRIER DETECTORS/si semiconductor detectors; ELECTRICAL PROPERTIES; ENERGY RESOLUTION; PERFORMANCE TESTING; SPECTROSCOPY; STABILITY; GOLD

53549 (CONF-9010212–2) **Gases for an SSC muon detector.** Christophorou, L.G. (Oak Ridge National Lab., TN (USA)); Datskos, P.G.; Carter, J.G. Oak Ridge National Lab., TN (USA). [1990]. 4p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400 ;AS05-76ER03956. From Symposium on detector research and development for the superconducting super collider; Fort Worth, TX (USA); 15-18 Oct 1990. Order Number DE91001519. Source: NTIS, PC A01/MF A01; OSTI; INIS; GPO Dep.

Recent measurements of electron drift velocities as a function of the density-reduced electric field E/N are reported for a number of unitary gases and the mixtures CO_2/CH_4 and $NH_3/CF_4/Ar$. Calculated values of the mean electron energy as a function of E/N are also reported for unitary gases and mixtures of CO_2/CH_4. 7 refs., 5 figs.

53550 (CONF-9010212–5) **Bipolar monolithic preamplifiers for SSC silicon calorimetry.** Britton, C.L. Jr. (Oak Ridge National Lab., TN (USA)); Todd, R.A.; Bauer, M.L.; Kennedy, E.J.; Bugg, W.M. Oak Ridge National Lab., TN (USA). [1990]. 4p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From Symposium on detector research and development for the superconducting super collider; Fort Worth, TX (USA); 15-18 Oct 1990. Order Number DE91001522. Source: NTIS, PC A01/MF A01; OSTI; INIS; GPO Dep.

This paper describes preamplifiers designed specifically to address the requirements of silicon calorimetry for the Superconducting Super Collider (SSC). Eight different preamplifiers designed for detector capacitances ranging from 20 pF to 500 pF and operating temperatures from 25°C to −20°C are discussed. The preamplifiers were fabricated with two different high-frequency processes (one with the VTC, Inc. VJ900 process, seven with the Harris Semiconductor VHF Process). The different topologies and their features are discussed in addition to the design methodologies employed. The results for noise, power consumption, speed, and radiation damage effects as well as data for post-damage annealing are presented for the VTC process preamplifier. Simulations for the VHF Process circuits are presented. This work was funded through SSC Generic Detector funding, SSC Detector Subsystem funding, and the Oak Ridge National Laboratory (ORNL) Detector Center.

53551 (CONF-9010212–6) **Considerations on the design of front-end electronics for silicon calorimetry for the SSC [Superconducting Super Collider].** Wintenberg, A.L. (Oak Ridge National Lab., TN (USA)); Bauer, M.L.; Britton, C.L. Jr.; Kennedy, E.J.; Todd, R.A.; Berridge, S.C.; Bugg, W.M. Oak Ridge National Lab., TN (USA). [1990]. 4p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From Symposium on detector research and development for the superconducting super collider; Fort Worth, TX (USA); 15-18 Oct 1990. Order Number DE91001619. Source: NTIS, PC A01/MF A01; OSTI; INIS; GPO Dep.

Some considerations are described for the design of a silicon-based sampling calorimetry detector for the Superconducting Super Collider (SSC). The use of silicon as the detection medium allows fast, accurate, and fine-grained energy measurements – but for optimal performance, the front-end electronics must be matched to the detector characteristics and have the speed required by the high SSC interaction rates. The relation between the signal-to-noise ratio of the calorimeter electronics and the charge collection time, the preamplifier power dissipation, detector capacitance and leakage, charge gain, and signal shaping and sampling was studied. The electrostatic transformer connection was analyzed and found to be unusable for a tightly arranged calorimeter because of stray capacitance effects. The method of deconvolutional sampling was developed as a means for pileup correction following synchronous sampling and analog storage. 3 refs., 6 figs.

53552 (CONF-9010212–7) **Cryogenic liquid mixtures for SSC calorimetry.** McCorkle, D.L. (Tennessee Univ., Knoxville, TN (USA). Dept. of Physics and Astronomy); Christophorou, L.G.; Faidas, H. Oak Ridge National Lab., TN (USA). [1990]. 3p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400 ;AS05-76ER03956. From Symposium on detector research and development for the superconducting super collider; Fort Worth, TX (USA); 15-18 Oct 1990. Order Number DE91001633. Source: NTIS, PC A01/MF A01; OSTI; INIS; GPO Dep.

The solubilities of a number of potential molecular additives to liquid Ar and to liquid Xe were calculated using the Scatchard-Hildebrand theory.

53553 (CONF-9010220–1) **An alpha/beta/gamma health physics instrument with pulse-shape discrimination.** McElhaney, S.A.; Chiles, M.M.; Ramsey, J.A. Oak Ridge National Lab., TN (USA). [1990]. 4p. Sponsored by U.S. Department of Defense. DOE Contract AC05-84OR21400. From 1990 IEEE nuclear science symposium; Arlington, VA (USA); 23-27 Oct 1990. Order Number DE91001634. Source: NTIS, PC A01/MF A01 - OSTI; GPO Dep.

A recent breakthrough in alpha scintillation detector design supports the feasibility of extending this new technology to the development of a monolithic alpha/beta/gamma ($\alpha/\beta/\gamma$) scintillation detector. The new scintillator is physically robust and chemically resistant to environmental conditions encountered in radiation monitoring, and yet inexpensive to manufacture. The use of pulse-shape discrimination electronics allows pulses from each scintillator to be separated for particle identification. An $\alpha/\beta/\gamma$ detector has a wide variety of possible applications including laundry monitoring, wastewater monitoring, air sampling, and health physics instrumentation. 2 refs., 1 fig.

53554 (DOE/ER/03956–9) **Elementary particle interactions: Progress report, October 1, 1989–September 30, 1990.** Bugg, W.M.; Condo, G.T.; Handler, T.; Hart, E.L.; Ward, B.F.L.; Close, F.E.; Christophorou, L.G. Tennessee Univ., Knoxville, TN (USA). Dept. of Physics. Oct 1990. 72p. Sponsored by U.S. DOE Energy Research. DOE Contract AS05-76ER03956. Order Number DE91001220. Source: NTIS, PC A04/MF A01; OSTI; INIS; GPO Dep.

This report discusses freon bubble chamber experiments exposed to μ^+ and neutrinos, photon-proton interactions; shower counter simulations; SLD detectors at the Stanford Linear Collider, and the detectors at the Superconducting Super Collider; elementary particle interactions; physical properties of dielectric materials used in High Energy Physics detectors; and Nuclear Physics. (LSP)

53555 (EGG–10617-4110) **Engineering design study for a warm liquid calorimeter.** Ballinger, T.; Debeling, A. EG and G Energy Measurements, Inc., Pleasanton, CA (USA). [1990]. 6p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC08-88NV10617. (CONF-9010212–4: Symposium on detector research and development for the superconducting super collider, Fort Worth, TX (USA), 15-18 Oct 1990). Order Number DE91001360. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

A systematic engineering study was conducted to quantitatively evaluate the feasibility of the Warm Liquid Calorimeter (WLC) concept for the Superconducting Super Collider (SSC). The baseline constraints were that each detector module could not exceed a weight of 20 tons, and that the main support structure plus detector modules could be assembled after the magnetic coil was emplaced. A systematic approach was developed that required a feedback loop that optimized the efficiency of the finite element structural analysis, assembly procedures, and hermeticity considerations. This approach is presented plus the results of the study.

53556 (GANIL-P–8924) **Tonneau: a multidetector array for charged particle and light fragment 4π detection.** Peghaire, A. (Grand Accelerateur National d'Ions Lourds (GANIL), 14 - Caen (FR)); Zwieglinski, B.; Rosato, E.; Jin, G.M.; Kasagi, J.; Doubre,

H.; Peter, J.; Guilbault, F.; Lebrun, C.; Cassagnou, Y.; Legrain, R. Grand Accelerateur National d'Ions Lourds (GANIL), 14 - Caen (France). 1989. 21p. Order Number DE91716322. Source: NTIS (US Sales Only), PC A03/MF A01.

The central part of the light-particle detection unit for the GANIL multidetector is a spherical (80 cm radius) shell of 2 mm thick NE 102A plastic scintillator. It spans the range of polar angles from θ = 30^0 - 150^0 and the azimuthal range ϕ = 0^0 - 360^0, and it is segmented into 72 individual $\Delta\theta$ = 60^0 and $\Delta\phi$ = 10^0 wide detection modules. Each module is viewed by a photomultiplier at each end which provide information on the particle impact position, atomic number Z and velocity. The performance of the modules was studied with an α-source and during several experiments with heavy ion beams from 25 up to 85 MeV/amu.

53557 (GSI–90-13) **Construction and operation of an universal stopping equipment for the fragment separator of the GSI Darmstadt.** Weckenmann, J. (Technische Hochschule Darmstadt (Germany, F.R.). Inst. fuer Kernphysik); Hanelt, E.; Schmidt, K.H. Gesellschaft fuer Schwerionenforschung mbH, Darmstadt (Germany, F.R.). Jul 1990. 28p. (In German). Order Number DE91717087. Source: NTIS (US Sales Only), PC A03/MF A01.

The fragment separator is a magnetic spectrometer, in which an especially-shaped layer of matter is applied as ion-optical element. The energy loss occurring there is accompanied by a series of unwanted effects like nuclear reaction, elecromagnetic dissociation, energy and angle straggling. These effects reduce on the one hand the total resolution of the separator and on the other hand the number of the fragments, which reach the exit of the separator. In the present study it was stated that the influence of these effects exhibits in most of the cases only a weak dependence on the material of the stopper. The ideal stopper material has a mass number, which corresponds nearly to the mass number of the selected fragment. If only one single stopper material will be applied, a material with low mass number seems to be the best compromise. Therefore for the universal stopper equipment of the fragment separator aluminium was selected. A further object of this study was the profile of the stopper. In a symmetrically constructed magnet spectrometer as the fragment separator the highest resolution is then reached, when the required particles are stopped in the whole width of their momentum distribution by a constant factor. This requirement leads to a curved profile of the stopper. It was stated that the profile can be approached by a linear wedge shape without a disadvantageous change of the resolution of the separator. The technical realization of the universal stopping equipment for the fragment separator consists mainly of very accurately manufactured, shiftable, and rotatable wedge-shaped layers. By means of a step-motor guiding the profiles required for the isotope separation can thus be obtained in a wide range. (orig.).

53558 (HMI-B–476) **Time-of-flight data acquisition unit (DAU) for neutron scattering experiments. Specification of the requirements and design concept. Version 3.1.** Herdam, G. (Hahn-Meitner-Institut Berlin GmbH (Germany, F.R.). Bereich Datenverarbeitung und Elektronik); Klessmann, H.; Wawer, W.; Adebayo, J.; David, G.; Szatmari, F. Hahn-Meitner-Institut Berlin GmbH (Germany, F.R.). Dec 1989. 68p. Order Number DE91717316. Source: NTIS (US Sales Only), PC A04/MF A01.

This specification describes the requirements for the Data Acquisition Unit (DAU) and defines the design concept for the functional units involved. The Data Acquisition Unit will be used in the following neutron scattering experiments: Time-of-Flight Spectrometer NEAT, Time-of-Flight Spectrometer SPAN. In addition, the data of the SPAN spectrometer in Spin Echo experiments will be accumulated. The Data Acquisition Unit can be characterised by the following requirements: Time-of-flight measurement with high time resolution (125 ns), sorting the time-of-flight in up to 4096 time channels (channel width $\geq$ 1 μs), selection of different time channel widths for peak and background, on-line time-of-flight correction for neutron flight paths of different lengths, sorting the detector position information in up to 4096 position channels, accumulation of two-dimensional spectra in a 32 Mbyte RAM memory (4 K time channels*4 K position channels*16 bits). Because of the stringent timing requirements the functional units of the DAU are hardware controlled via tables. The DAU is part of a process control system which has access to the functional units via the VMEbus in order to initialise, to load tables and control information, and to read status information and spectra. (orig.) With 18 figs.

53559 (IAERU–8904, pp. 75-85) **X-ray imaging by means of the photostimulable phosphor.** Takahashi, Kenji (Fuji Photo Film Co. Ltd., Tokyo (Japan)). Rikkyo Univ., Yokosuka, Kanagawa (Japan). Inst. for Atomic Energy. Jan 1990. (In Japanese). (CONF-8906351–: 5. IAERU seminar, Tokyo (Japan), 24 Jun 1989). In *Proceedings of IAERU seminar-V.* 89p. Order Number DE90513828. Source: NTIS (US Sales Only), PC A05/MF A01.

When excited by ionizing radiations such as X-rays, electron beams, ultraviolet rays, etc., photostimulable phosphors are capable of storing the energy in quasi-stable states at the same time as emitting spontaneous luminescence. Afterwards, they can emit again corresponding to the absorbed energy when stimulated by visible or infra-red radiation. 'Imaging Plate' is a new type of integrating area detector for X-rays. It can store X-ray image data in the wide range of exposure with high sensitivity and sharpness. The image recording layer of it is composed of a photostimulable phosphor, BaFX: Eu^{2+}(X = Br, I), which is coated on a flexible polyester support. After exposed by X-rays just like the conventional screen-film combination, the imaging plate is fed to the Computed Radiography (CR) system. Then, it is scanned by a He-Ne laser beam and the photostimulated emission which bears the time-series image information is converted to electric signals. After being digitized, they are processed appropriately in accordance with the anatomic region and the exposure method. Finally, the processed data are written on a CR film using a He-Ne laser beam and the exposed film is developed by an automatic film processor to produce the computed radiograph. The mechanism of photostimulated luminescence in BaFX: Eu^{2+} is interpreted as follows. The excitation by X-rays and the photostimulation of luminescence by visible light are caused by the reversible processes of $Eu^{2+} \rightleftarrows Eu^{3+}$ and F^+-centers $\rightleftarrows$ F. BaF(Br·I): EU^{2+} shows higher stimulability than BaFBr: Eu^{2+}, since the former has the greater number of F^+-centers than the latter. That was selected for the new imaging plates, ST-III and HR-III. By utilizing these high-speed imaging plates, a compact CR system of distributive processing type, FCR-7000, has been developed. (Abstract Truncated)

53560 (IAERU–8904, pp. 63-74) **Application of thermoluminescence to age determination and dose determination.** Nagatomo, Tsuneto (Nara Univ. of Education (Japan)). Rikkyo Univ., Yokosuka, Kanagawa (Japan). Inst. for Atomic Energy. Jan 1990. (In Japanese). (CONF-8906351–: 5. IAERU seminar, Tokyo (Japan), 24 Jun 1989). In *Proceedings of IAERU seminar-V.* 89p. Order Number DE90513828. Source: NTIS (US Sales Only), PC A05/MF A01.

For a mineral substance to serve for age or dose determination, it should have good thermoluminescent characteristics including high reproducibility, small fading and proportionality of emission to absorbed dose. Of the various natural crystals, quartz can meet these requirements most closely. The report discusses some techniques for applying thermoluminescence of minerals, quartz in particular, to age and dose determination. For age determination, various processes are available for samples in different conditions or of different ages. Those using quartz include the coarse quartz particle method, pre-dose method, high-temperature region method, fine particle method, flake method and subtraction method. The procedure of age determination by the coarse quartz particle method is described in detail and some results of age determination by this method are presented. Thermoluminescence has also been used for dose determination in Hiroshima and Nagasaki. The use of thermoluminescence may be the only way of accurately estimating the gamma-ray dose from the atomic bombs. (N.K.).

53561 (IFUSP-P–812) **Manual for the SPM-CAMAC system for data acquisition.** Ribas, R.V. Sao Paulo Univ., SP (Brazil). Inst. de Fisica. Dec 1989. 26p. (In Portuguese). Order Number DE91606124. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

This manual describes the data acquisition system SPM in the CAMAC configuration that is: the hardware known as SPM-memory being replaced by CAMAC. (A.C.A.S.).

53562 (KEK–89-23, pp. 74-117) **The τ-charm factory: physics, machine and detector.** Kirkby, J. (European Organization for Nuclear Research, Geneva (Switzerland)). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Mar 1990. (CONF-8905220–: KEK topical conference on e^+e_- collision physics, Tsukuba (Japan), 17-19 May 1989). In *Proceedings of the KEK topical conference on e^+e^- collision physics.* 638p. Order Number DE90506150. Source: NTIS (US Sales Only), PC A99/MF A01.

We describe a new experiment that will carry out precise studies of the third generation leptons, τ and ν_τ; the second generation quark family, through the decays of $D^\pm$, D^0 and $D_s{}^\pm$; and the spectrum of gluonic and other new light particles in the decays of J/ψ and ψ'. The experiment - the τ-charm Factory (τcF) - involves a high-resolution detector integrated with an e^+e^- collider operating in the energy range $3.0 \leq E_{cm} \leq 4.25$ GeV with a maximum luminosity 10^{33} $cm^{-2}s^{-1}$. (author).

53563 (KURRI-TR–333, pp. 6-9) **An experimental proposal to measure the velocity distribution by collinear laser spectroscopy.** Inamura, T. (Institute of Physical and Chemical Research, Wako, Saitama (Japan)). Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst. Apr 1990. (In Japanese). (CONF-9001108–: 2. specialist research meeting on studies of nuclear chemistry and nuclear physics at research reactor, Kumatori (Japan), 17-18 Jan 1990). In *Proceedings of the 2nd specialist research meeting on studies of nuclear chemistry and nuclear physics at research reactor.* 101p. Order Number DE90513872. Source: NTIS (US Sales Only), PC A06/MF A01.

Published in summary form only. ISOTOPE SEPARATION/laser spectroscopy; DOPPLER BROADENING; ARGON 40 BEAMS; RESOLUTION

53564 (KURRI-TR–333, pp. 33-36) **$4\pi\beta$(ppc)-γ(HPGe) coincidence counting using a Bi-dimensional data acquisition system and measurement of γ-ray emission probability.** Miyahara, H. (Nagoya Univ. (Japan). Faculty of Engineering). Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst. Apr 1990. (In Japanese). (CONF-9001108–: 2. specialist research meeting on studies of nuclear chemistry and nuclear physics at research reactor, Kumatori (Japan), 17-18 Jan 1990). In *Proceedings of the 2nd specialist research meeting on studies of nuclear chemistry and nuclear physics at research reactor.* 101p. Order Number DE90513872. Source: NTIS (US Sales Only), PC A06/MF A01.

Published in summary form only. FOUR-PI COUNTING/data acquisition systems; PHOTON EMISSION/coincidence methods; GAMMA RADIATION; BARIUM 133; DECAY; HIGH-PURITY GE DETECTORS; ABSOLUTE COUNTING; POTASSIUM 42; EFFICIENCY

53565 (MIC–90-04389/XAB) **Intercomparison of Canadian external dosimetry processors for radiation protection. Report No. INFO-0331.** Working Group on External Dosimetry, Ottawa, ON (Canada). ©1989. 98p. Source: NTIS, PC EE12/MF E01.

There are 5 organizations which perform external beta/gamma dosimetry in Canada. Through these 5 external dosimetry processors, 4 distinct methods are used in determining whole-body (deep) dose. In order to quantify the differences in doses observed between the processors, dosimeters from each of the 5 organizations were exposed to the same radiation fields. The resulting doses were then evaluated by each respective processor by reading its own dosimeters in the normal way. This led to the stage 2 intercomparison which is the subject of this report. The second stage involved exposing the dosimeters to radiation fields in areas in power reactor working environments.

53566 (ORNL/FTR–3797) **[Test, calibrate, and prepare a BGO photon detector system]: Foreign trip report, September 25, 1989–October 4, 1990.** Awes, T.C. Oak Ridge National Lab., TN (USA). 19 Oct 1990. 11p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE91001527. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The traveler spent the year at CERN primarily to test, calibrate, and prepare a BGO photon detector system for use in the August 1990 run of WA80 with sulfur beams and for use in future planned runs with an expanded BGO detector. The BGO was used in test-beam runs in December 1989 and April–May 1990 and in the August data-taking run. The Midrapidity Calorimeters (MIRAC) were also prepared in a new geometry for the August run with a new transverse energy trigger. The traveler also continued to refine and carry out simulations of photon detector systems in present and future planned photon detection experiments. The traveler participated in several WA80 collaboration meetings, which were held at CERN throughout the period of stay. Invited talks were presented at the Workshop on High Resolution Electromagnetic Calorimetry in Stockholm, Sweden, November 9–11, 1989, and at the International Workshop on Software Engineering, Artificial Intelligence, and Expert Systems for High-Energy and Nuclear Physics at Lyon, France, March 19–24, 1990. The traveler participated in an experiment to measure particle–particle correlations at 30-MeV/nucleon incident energies at the SARA facility in Grenoble from November 11–24, 1989.

53567 (PTB-Dos–19) **Automatic measuring device for beta dosimetry.** Drake, K.H.; Boehm, J. Physikalisch-Technische Bundesanstalt, Braunschweig (Germany, F.R.). Dosimetrie. Apr 1990. 76p. (In German). Source: Available from Physikalisch-Technische Bundesanstalt, Braunschweig (Germany, F.R.). Dosimetrie.

A measuring device is described which enables dose rates in soft tissue produced by beta radiation to be measured. The main components of this device are an extrapolation chamber and a sensitive current-measuring system. The current of the extrapolation chamber is measured automatically for preselected chamber depths together with the temperature, pressure and relative humidity of the air of the collecting volume. An IBM-compatible Zenith-AT computer with a memory of 640 kByte and a 80 MByte hard disk controls the whole measuring procedure and evaluates the data by means of self-developed Turbo-Pascal programs. The components of the measuring device, their calibration, several measuring programs and preparatory measurements for the operation of the device are described in detail in this report. The capacity of the device is demonstrated with examples of experimental data on an extrapolation curve and a depth dose curve. The report is supplemented by a number of details in the appendix. Besides wiring diagrams of self-developed electronis circuits formulas for calculating the capacity of a guard ring capacitor and the air density, for example, are also included. (orig.).

53568 (PTB-N–2) **Experimental investigation into the influence of neutron energy, angle of incidence and phantom shape on the response of individual neutron dosemeters: Detailed analysis of results for the albedo neutron dosemeter in use at the PTB.** Bauer, B.W.; Alberts, W.G.; Luszik-Bhadra, M.; Siebert, B.R.L. Physikalisch-Technische Bundesanstalt, Braunschweig (Germany, F.R.). Neutronenphysik. Mar 1990. 55p. Source: Available from Physikalisch-Technische Bundesanstalt, Braunschweig (Germany, F.R.). Neutronenphysik.

The universal albedo dosemeter, employed in radiation protection practice for neutron individual monitoring, was investigated in various monoenergetic and broad-spectrum reference neutron fields of the PTB. The fluence response was measured with respect to the influence of neutron energy, angle of incidence and the shape of phantoms. The results include free-in-air response at low energies, especially with thermal neutrons, and a detailed study of various phantoms using ^{252}Cf fission neutrons. The data provide a basis for the discussion of the use of calibration phantoms and procedures. (orig.).

53569 (PTB-Ra–24) **Significance of summing corrections in gamma spectrometry with germanium detectors.** Debertin, K.; Schoetzig, U. Physikalisch-Technische Bundesanstalt, Braunschweig (Germany, F.R.). Radioaktivitaet. May 1990. 69p. (In German). Source: Available from Physikalisch-Technische Bundesanstalt, Braunschweig (Germany, F.R.). Radioaktivitaet.

In gamma-ray spectrometry with germanium detectors summing effects have to be taken into account, in particular at low source-detector distances. The importance of these effects is frequently underestimated. Corrections become necessary, if two or more photons originating from the same decay are detected simultaneously. In this work the consequences of summing effects on the pulse height spectrum are illustrated by several examples, and methods are compiled by which a calculation or at least an estimation of the necessary corrections is possible. (orig.).

53570 (UEF–01-90) **Production of readout boards for H1 liquid argon calorimeter.** Antos, J.; Ban, J.; Ferencei, J.; Kurca, T.; Murin, P.; Seman, M.; Spalek, J.; Stefan, P. Slovenska Akademia Vied, Kosice (Czechoslovakia). Ustav Experimentalnej Fyziky. Mar 1990. 13p. Order Number DE91606114. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

Technical details of the technology used by the Institute of Experimental Physics in Kosice for the production of readout boards for the H1 liquid argon calorimeter are described. (author). 2 figs., 2 refs.

53571 **A compact, time-resolved H^+ spectrometer design for megavolt ion diodes.** Struckman, C.K. (Cornell Univ., Ithaca, NY (USA). Lab. of Plasma Studies); Kusse, B.R. 16p. Laboratory of Plasma Studies, Cornell University, Ithaca, NY (USA) (1990).

Technical Paper LPS90-3.

The design of a compact ($\leq$10 cm^3) time resolved ($\leq$ 5 ns) spectrometer for megavolt ion diodes is described. The spectrometer consists of several ultra thin ($\approx$ 1 μm), large area ($\approx$ 1 cm^2) surface barrier detectors. They are arranged so that ions are transmitted through many detectors until they are stopped by the semiconductor material. The electron-hole pairs produced as the ions are stopped by the material can be rapidly detected by placing metal contacts on both sides of the surface barrier detectors and totally depleting the thin semiconductor region.

53572 **Versatility of the CFR algorithm for limited angle reconstruction.** Fujieda, I. (Lawrence Berkeley Lab., CA (USA)); Heiskanen, K.; Perez-Mendez, V. *IEEE Transactions on Nuclear Science (Institute of Electrical and Electronics Engineers) (USA)*, 7(2): 585-588 (Apr 1990). DOE Contract AC03-76SF00098. (CONF-900143–: Institute for Electronic and Electrical Engineers (IEEE) nuclear science symposium, San Francisco, CA (USA), 15-19 Jan 1990).

The constrained Fourier reconstruction (CFR) algorithm and the iterative reconstruction-reprojection (IRR) algorithm are evaluated based on their accuracy for three types of limited angle reconstruction problems. The cFR algorithm performs better for problems such as Xray CT imaging of a nuclear reactor core with one large data gap due to structural blocking of the source and detector pair. For gated heart imaging by Xray CT, radioisotope distribution imaging by PET or SPECT, using a polygonal array of gamma cameras with insensitive gaps between camera boundaries, the IRR algorithm has a slight advantage over the CFR algorithm but the difference is not significant.

4402 Radiation Effects on Instrument Components, Instruments, or Electronic Systems

Refer also to citation(s) 53467, 53513, 53598

53573 (AD-A–223877/2/XAB) **Transient annealing characterization of irradiated MOSFETs.** Cousins, T.; Qureshi, K.M. Defence Research Establishment, Ottawa, ON (Canada). Jan 1990. 44p. (DREO–1030). Source: NTIS, PC A03/MF A01.

Abstract in English and French.

The electrical response of metal-oxide-silicon (MOS) technologies to incident nuclear (especially photon) radiation is a very complex, time-dependent function. This report reviews the physical processes governing this response and then experimentally examines them with the aid of the TATS-400 (Transient Annealing Test System). MOSFET responses to steady-state and pulsed photon and electron beams are characterized in terms of such parameters as threshold voltage shift and interface and oxide trap densities. The results show good agreement between experiment and theory in terms of the expected trends, however in order to conduct more meaningful tests, devices with much better-known geometries must be procured.

53574 (SAND–90-0736C) **Optically-triggered GaAs thyristor switches: Integrated structures for environmental hardening.** Carson, R.F.; Weaver, H.T.; Hughes, R.C.; Zipperian, T.E.; Brennan, T.M.; Hammons, B.E. Sandia National Labs., Albuquerque, NM (USA). [1990]. 11p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-901102–1: Annual meeting of the Optical Society of America, Inc., Boston, MA (USA), 4-9 Nov 1990). Order Number DE91001355. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Optically-triggered thyristor switches often operate in adverse environments, such as high temperature and high dose-rate transient radiation, which can result in lowered operating voltage and premature triggering. These effects can be reduced by connecting or monolithically integrating a reverse-biased compensating photodiode or phototransistor into the gate of the optically-triggered thyristor. We have demonstrated the effectiveness of this hardening concept in silicon thyristors packaged with photodiodes, and in gallium arsenide optically-triggered thyristors monolithically integrated with compensating phototransistors.

53575 (SAND–90-2294C) **Effect of radiation-induced charge on 1/f noise in MOS devices.** Meisenheimer, T.L.; Fleetwood, D.M. Sandia National Labs., Albuquerque, NM (USA). [1990]. 7p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-901235–1: 21. IEEE semiconductor interface specialists conference, San Diego, CA (USA), 6-8 Dec 1990). Order Number DE90015991. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

We have measured 1/f noise in MOS transistors as a function of gate and drain bias, total ionizing dose, and post-irradiation biased annealing time. The transistors tested varied in size, radiation hardness, and process technology. The radiation-induced 1/f noise correlates strikingly with the oxide trap charge through irradiation and anneal, but not with interface-trap charge, for frequencies up to 10 kHz. This implies the oxide trapped charge is the predominant factor which leads to the increased 1/f noise in irradiated MOS devices. 17 refs., 11 figs.

4405 Thermal Instrumentation

53576 (CONF-9009274–1) **Laser-induced fluorescence of phosphors for remote cryogenic thermometry.** Beshears, D.L.; Capps, G.J.; Cates, M.R.; Simmons, C.M.; Schwenterly, S.W. Oak Ridge National Lab., TN (USA). [1990]. 13p. Sponsored by National Aeronautics and Space Administration. DOE Contract AC05-84OR21400. From OE/Fibers '90; San Jose, CA (USA); 16-21 Sep 1990. Order Number DE91001221. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Remote cryogenic temperature measurements can be made by inducing fluorescence in phosphors with temperature-dependent emissions and measuring the emission lifetimes. The thermographic phosphor technique can be used for making precision, non-contact, cryogenic temperature measurements in electrically hostile environments, such as high DC electric or magnetic fields. NASA is interested in utilizing these thermographic phosphors for mapping hot spots on cryogenic tank walls. Europium-doped lanthanum oxysulfide (La_2O_2S:Eu) and magnesium fluorogermanate doped with manganese ($Mg_4(F)GeO_6$:Mn) are suitable for low-temperature surface thermometry. Several emission lines, excited by a 337 nm UV laser, provide fluorescence lifetimes having logarithmic dependence with temperatures from 4 to 125 Kelvin. A calibration curve for both La_2O_2S:Eu and $Mg_4(F)GeO_6$:Mn are presented as well as emission spectra taken at room temperature and 7 Kelvin.

4406 Optical Instrumentation

Refer also to citation(s) 53192, 53323, 53403, 53466, 53472, 53474, 53475, 53482

53577 (BNL–44865) **The MPI/AIT X-ray imager (MAXI): High speed pn-CCD's for x-ray detection.** Strueder, L. (Max-Planck-Institut fuer Physik und Astrophysik, Garching (Germany, F.R.). Inst. fuer Astrophysik); Braeuninger, H.; Meier, M.; Predehl, P.; Reppin, C.; Sterzik, M.; Truemper, J.; Cattaneo, P.; Hauff, D.; Lutz, G.; Schuster, K.F.; Schwarz, A.Brookhaven National Lab., Upton, NY (USA). Jun 1989. 15p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. (CONF-890247–4: 5. European symposium on semiconductor detectors: new developments on radiation detectors, Munich (Germany, F.R.), 21-23 Feb 1989). Order Number DE91001109. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

MAXI (MPI/AIT X-RAY Imager) is part of a proposal submitted to the European Space Agency (ESA) as focal plane instrumentation of the X-ray Multi Mission (XMM). Within a collaboration of 13 European institutes we have proposed a fully depleted (sensitive) pn CCD of 280 μm thickness with a homogeneous sensitive area of 36 cm^2 and a pixel size of 150 x 150 μm^2 which is well matched with the telescope's angular resolution of 30 arcsec, translating to a position resolution of approximately 1 mm in the focal plane. The X-ray sensitivity is higher than 90% from 250 eV up to 10 keV, the readout time in the full frame mode of the complete focal plane will be 2 ms with a readout noise of better than 5 e$^-$ (rms). Prototypes of all individual components of the camera system have been fabricated and tested. The camera concept will be presented. The measured transfer properties of the CCD and the on-chip electronics will be treated. Taking into account the coupling of the on-chip amplifier to the following front-end electronics the expected performance will be derived.

53578 (BNL–45153) **In search of the elusive true surface.** Takacs, P.Z. (Brookhaven National Lab., Upton, NY (USA)); Furenlid, K.; Church, E.L. Brookhaven National Lab., Upton, NY (USA). Aug 1990. 15p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. (CONF-900756–51: SPIE's international symposium on optical and optoelectronic applied science and engineering exhibit, San Diego, CA (USA), 8-13 Jul 1990). Order Number DE91001110. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Measurement of an optical surface by a figure measuring device allows one to make an estimate of the shape of the surface. The absolute accuracy in locating the "true" surface depends on the sources of error in the measurement process – both random errors and systematic errors. Analysis procedures have been developed to extract surface figure information from optical profiler measurements on large mirrors. Rigid-body orientation effects are important in analyzing the shape of the off-axis ellipsoidal reflectors used as gazing incidence mirrors in soft-ray synchrotron instrumentation. Knowledge of the noise level and optical aberration function of the Long Trace Profiler allow us to place error bars smaller than λ/100 on measurements of surfaces that are more than 500 mm long. 6 refs., 11 figs.

53579 (CONF-8906311–) **Proceedings of the Oak Ridge National Laboratory/Brookhaven National Laboratory workshop on neutron scattering instrumentation at high-flux reactors.** McBee, M.R. (ed.); Axe, J.D.; Hayter, J.B. Oak Ridge National Lab., TN (USA). Jul 1990. 74p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From ORNL/BNL workshop on neutron scattering instrumentation at high flux reactors; Oak Ridge, TN (USA); 5-7 Jun 1989. Order Number DE91001003. Source: NTIS, PC A04/MF A01; OSTI; INIS; GPO Dep.

For the first three decades following World War II, the US, which pioneered the field of neutron scattering research, enjoyed uncontested leadership in the field. By the mid-1970's, other countries, most notably through the West European consortium at Institut Laue-Langevin (ILL) in Grenoble, France, had begun funding neutron scattering on a scale unmatched in this country. By the early 1980's, observers charged with defining US scientific priorities began to stress the need for upgrading and expansion of US research reactor facilities. The conceptual design of the ANS facility is now well under way, and line-item funding for more advanced design is being sought for FY 1992. This should lead to a construction request in FY 1994 and start-up in FY 1999, assuming an optimal funding profile. While it may be too early to finalize designs for instruments whose construction is nearly a decade removed, it is imperative that we begin to develop the necessary concepts to ensure state-of-the-art instrumentation for the ANS. It is in this context that this Instrumentation Workshop was planned. The workshop touched upon many ideas that must be considered for the ANS, and as anticipated, several of the discussions and findings were relevant to the planning of the HFBR Upgrade. In addition, this report recognizes numerous opportunities for further breakthroughs on neutron instrumentation in areas such as improved detection schemes (including better tailored scintillation materials and image plates, and increased speed in both detection and data handling), in-beam monitors, transmission white beam polarizers, multilayers and supermirrors, and more. Each individual report has been cataloged separately.

53580 (LA-UR–90-2900) **Faraday effect current sensing using a Sagnac interferometer with a 3 [times] 3 coupler.** Veeser, L.R. (Los Alamos National Lab., NM (USA)); Day, G.W. Los Alamos National Lab., NM (USA). [1990]. 5p. Sponsored by U.S. DOE Office of Administration and Human Resource Management. DOE Contract W-7405-ENG-36. (CONF-901229–2: 7. optical fibre sensors conference, Sydney (Australia), 4-7 Dec 1990). Order Number DE90016436. Source: NTIS, PC A02/MF A01 - OSTI.

We demonstrate a fiber optic current sensor based on a Sagnac interferometer with a 3 x 3 coupler. Compared to the more common Sagnac interferometer with a 2 x 2 coupler, this design offers the additional benefits of a greater response for small signals and the unambiguous interpretation of signals that exceed the period of the response function. 6 refs., 6 figs.

53581 (SAND–90-2148C) **Travelling wave Faraday effect fiber current sensors.** Cernosek, R.W. Sandia National Labs., Albuquerque, NM (USA). [1990]. 4p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-901229–1: 7. optical fibre sensors conference, Sydney (Australia), 4-7 Dec 1990). Order Number DE90015701. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

A travelling wave Faraday effect fiber current sensor, consisting of a helical optical fiber coil immersed in a dielectric medium, has been demonstrated. Improved phase matching conditions have led to measured bandwidth enhancements of greater than a factor of four. Sensitive devices with multi-gigahertz bandwidths are possible using this technique. 7 refs., 3 figs.

53582 (UCRL-ID–104836) **Twelve signals multiplexed with the Lawrence Livermore National Laboratory (LLNL) optical streak camera.** Lerche, R.A.; Griffith, R.L. Lawrence Livermore National Lab., CA (USA). 28 Aug 1990. 4p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-48. Order Number DE91000066. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

At our Nova laser facility, the temporal history of incident and reflected laser energy is recorded on LLNL optical streak cameras. Currently, six cameras are used to record the incident 1.06-μm, incident 0.35μm power of each of the ten Nova beams. Each camera records seven multiplexed signals: typically one signal from each of five beam lines, a fiducial pulse, and time mark generator signal. The optical signals are transported to the camera through optical fibers. The output end of each fiber is placed in the slit plane of the camera. The light exiting the fiber is focused to the streak camera photocathode by the streak camera relay lens. One camera can record a signal from each of the ten Nova beams plus a fiducial and time mark generator signal if the number of multiplexed channels can be increased from seven to twelve. This would allow one camera to record the same data that currently requires two cameras. At a savings of $150 per camera/CCD system, this represents a savings of $450K. Additionally, camera/CCD maintenance and operation complexity would be cut in half and three streak cameras would be freed for use in other experiments. Recent laboratory measurements suggest that the number of multiplexed signals per camera can indeed be increased from seven to twelve without noticeably increasing the crosstalk between signal channels. In this memorandum, we describe recent work in which seven and twelve signals were multiplexed to one streak camera. We describe the effect focusing has on the crosstalk channels and the effect wavelength has on focusing. We conclude the memorandum with suggestions concerning the implementation of a twelve channel system.

4408 Miscellaneous Instrumentation

Refer also to citation(s) 52986, 53046, 53362, 53451, 53579, 53869, 54396

53583 (CEA-DAS–678) **Tightness measurement methods for containment of great volume.** Desmoulin, F. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (FR). Dept. d'Analyse de Surete); Guillaume, D.; Cassette, P. CEA Centre

d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. d'Analyse de Surete. Jan 1990. 8p. (In French). (CONF-8911246–: PMDS 89: Protection, handling, detection and Safety meeting, Marseille (France), 7-9 Nov 1989). Order Number DE91716240. Source: NTIS (US Sales Only), PC A02/MF A01.

Different methods of leakage rate measurements are utilizable for evaluating the leakage rate of containment of great volume. Among the methods tested, the method by gaseous tracers seems the most universal. The technic is easy to use and gives a measure uncertainty of ten per cent.

53584 (DOE/CE/15401–T9) **A miniature inexpensive, oxygen sensing element: Quarterly report, July 1, 1990–September 31, 1990.** Arenz, R.W. CeramPhysics, Inc., Westerville, OH (USA). 30 Sep 1990. 8p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract FG01-88CE15401. Order Number DE91001136. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

We have made good progress in formulating our procedures for assembly of prototype sensor parts to alleviate problems of oxidation/reduction of components and possibly deleterious interactions of component materials. We have been working exclusively with the simplest form of prototype, i.e. without an incorporated heater. This has been to save assembly time and materials and to simplify the system of the components while we have dealt with overriding, "non-heater" assembly issues. It is anticipated future inclusion of the heater will introduce some new problems to be overcome, but we do not think these will be overwhelming.

53585 (LSTM–266/T/89) **Coriolis-effect in mass flow metering.** Raszillier, H.; Durst, F. Erlangen-Nuemberg Univ., Erlangen (Germany, F.R.). Lehrstuhl fuer Stroemungsmechanik. 1989. 49p. Source: Available from Erlangen-Nuernberg Univ., Erlangen (Germany, F.R.). Lehrstuhl fuer Stroemungsmechanik.

The paper aims at a detailed description of the physical background for the so called Coriolis mass flow meter. It presents essentially an analysis of the (free) vibration modes of a fluid conveying straight pipe segment. Due to the inertial effects of the flowing fluid, mainly the Coriolis force, these modes deviate in shape (and in frequency) from those appearing in the absence of fluid motion. The effect of fluid inertia may, therefore, be exploited for the purpose of flow measurement. The analysis is performed under a simplifying approximation: The pipe is considered as a beam, the fluid as a moving string. This approximation leaves the fluid with only one degree of freedom, connected with its mean velocity, and eliminates an infinity of degrees of freedom of the pipe. Yet it keeps the essential features of the phenomenon. The equations describing the vibrations are derived variationally, with the constraint of a common vibration amplitude of both fluid and pipe. The Lagrange multiplier associated with the constraint gives the interaction force between pipe and fluid. The modes are determined by a perturbation procedure, wherein the small (perturbation) parameter is related to the fluid velocity. The analysis shows, as main result, how the time delay between the vibrations of two appropriately chosen points of the pipe may serve to determine the mass flow rate of the fluid. Other aspects of the problem, like the precise role of the Coriolis force, are considered. The possible improvement of the used approximation is discussed. (orig.).

53586 (ORNL/TM–11262) **Optimizing the temperature compensation of an electronic pressure measurement system.** Maxey, L.C.; Blalock, T.V. Oak Ridge National Lab., TN (USA). Aug 1990. 27p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC05-84OR21400. Order Number DE91000522. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

In an effort to minimize temperature sensitivity, the pressure measurement channels in the sensor/electronics modules of a high-resolution multiplexed pressure measurement system were analyzed. The pressure sensor (a silicon diaphragm strain gage) was known to have two temperature-dependent parameters. Component testing revealed that the current source driving the pressure sensor was also temperature sensitive. Although the transducer manufacturer supplies empirically selected temperature compensation resistors with each transducer, it was determined that the temperature sensitivity compensation could be optimized for this application by changing one of these resistors. By modifying the value of the sensitivity compensation resistor to optimize performance in this application, the temperature sensitivity of the pressure measurement channels was reduced by more than 60%.

53587 (ORNL/TM–11503) **Radioluminescent (RL) airfield lighting system program: Annual report, October 1, 1986–September 30, 1987.** Tompkins, J.A. (Westinghouse Electric Corp., Las Vegas, NV (USA)); Haff, K.W.; Schultz, F.J. Oak Ridge National Lab., TN (USA). Sep 1990. 74p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC05-84OR21400. Order Number DE91001007. Source: NTIS, PC A04/MF A01 - OSTI; GPO Dep.

In 1980, the US Air Force Engineering and Services Center (AFESC) at Tyndall Air Force Base, Florida, requested that the Radioisotope Technology Group of Oak Ridge National Laboratory (ORNL) develop large-scale, tritium-powered, radioluminescent (RL) airfield lighting systems. The RL lighting systems possess the advantages of being portable, requiring no electrical power source, having a long shelf life, and being unaffected by environmental extremes. These characteristics make the RL system well-suited for harsh environments where the cost of electrical power production is high and traditional incandescent airfield lighting systems are difficult to maintain. RL lighting is typically a large-surface-area, low-intensity light source that operates 100% of the time. The RL light sources gradually decrease in brightness over time, so periodic replacement (every 6 to 8 years) is necessary. RL lighting functions best in low ambient light, which provides the high contrast ratios necessary for successful use of these devices. 12 figs., 8 tabs.

53588 (UCRL-JC–104433) **Materials impurity analysis by means of nuclear resonance reactions.** Hornady, R.S. Lawrence Livermore National Lab., CA (USA). Sep 1990. 11p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-901116–22: 11. international conference on the application of accelerators in research and industry, Denton, TX (USA), 5-8 Nov 1990). Order Number DE91001758. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

An automated beam line for measurement of trace impurities in materials is installed on the FN tandem in the Center for Accelerator Mass Spectrometry, LLNL. The major purpose of the beam-line system is to determine the diffusion of water into glasses by use of the $^{19}F(p,\alpha\gamma)^{16}O$ reaction. This study is stimulated by the radiation-waste-isolation program; however, the system is applicable to studies of other impurities in many material matrices. The target wheels, each of which holds twenty-four samples, can be changed in less than an hour. The beam-line control system both indexes the target wheel and controls the tandem energy as it steps through the requested measurement protocol. The tandem control system, in response to a request, adjusts the terminal potential and other transport elements to maintain constant spot size and location.

53589 (Y–2431) **Precision pulse-timing instrumentation for ultrasonic nondestructive testing.** Duncan, M.G. Oak Ridge Y-12 Plant, TN (USA). 31 Aug 1990. 57p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC05-84OS21400. Order Number DE91000067. Source: NTIS, PC A04/MF A01 - OSTI; GPO Dep.

A new, pulse-timing discriminator and B-scan time-to-pulse-height converter have been developed for the inspection of production parts. The discriminator is easy to operate and features automatic echo gating and automatic pulse polarity discrimination. This instrument combines the noise-blanking advantages of threshold discrimination with the echo-timing precision of zero-crossing discrimination to improve measurement accuracy by a factor of two over the best precious techniques. When used with the discriminator, the B-scan unit allows detection of flaws at depths less than one-fourth those obtainable with commercially available instruments. 3 refs., 20 figs., 2 tabs.

45 MILITARY TECHNOLOGY, WEAPONRY, AND NATIONAL DEFENSE

Refer also to citation(s) 53162, 53587, 53601

53590 (AD-A–224353/3/XAB) **Effect of electromagnetic fields on the stability of a perfectly conducting, axisymmetric**

shaped-charge jet. Final report, January-September 1989. Powell, J.D.; Littlefield, D.L. Army Armament Research and Development Command, Aberdeen Proving Ground, MD (USA). Ballistics Research Lab. Jun 1990. 28p. (BRL-TR–3108). Source: NTIS, PC A03/MF A01.

The stability characteristics of a shaped-charge jet which carries an electrical current are investigated. The jet is assumed to be perfectly plastic, perfectly conducting, and axisymmetric. The equations which govern the behavior of the jet are solved numerically using first-order perturbation theory, after the surface of the jet has been subjected to some arbitrary disturbance. The solution of these equations indicates that the jet is unstable. The growth rate of the instability depends upon the relative importance of inertial, electrical, and plastic forces, and upon the size of the disturbance wavelength relative to the jet radius. It is argued and demonstrated from the numerical solutions that the electromagnetic forces always make the jet more unstable than it would be in their absence. Application of the theory suggests that electromagnetic fields may be capable of enhancing jet breakup on a time scale of practical interest, but more work, both theoretical and experimental, needs to be done before definite conclusions can be drawn.

53591 (ORNL–6637) **Navy Mobility Fuels Forecasting System Phase 6 report: Impacts of a military disruption on Navy fuel availability and quality.** Hadder, G.R.; Davis, R.M. Oak Ridge National Lab., TN (USA). Sep 1990. 50p. Sponsored by U.S. Department of Defense. DOE Contract AC05-84OR21400. Order Number DE91000540. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The Refinery Yield Model of the Navy Mobility Fuels Forecasting System has been used to study the impacts of a severe military disruption on the production of Navy JP-5 jet fuel and F-76 marine diesel fuel in the year 1995. The global petroleum supply reduction due to the disruption was about 40 percent of the business-as-usual supply. Regional production cost increases for JP-5 were between $3 and $11 per gallon during the disruption. For F-76, the production cost increases were between $3 and $5 per gallon. The disruption caused substantial degradations for certain fuel quality properties of F-76 produced in the Pacific basin and in southern Europe. During both business-as-usual and disruption, the most prevalent Navy fuel quality problem was F-76 instability due to high levels of light cycle oils. 37 refs., 1 fig., 21 tabs.

53592 (ORNL/TM–11275) **Arsenal of democracy in the face of change: Precision Guided Munitions (PGMs), their evolution and some economic considerations, Working Paper No. 4.** Chester, C.V. Oak Ridge National Lab., TN (USA). Aug 1990. 36p. Sponsored by U.S. Federal Emergency Management Agency. DOE Contract AC05-84OR21400. Order Number DE91000533. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A brief study was made of some of the forces driving the move to Precision Guided Munitions (PGMs), including the quest for military effectiveness, combat experience, and logistic compression. PGMs cost from a few hundred to a few thousand dollars per Kg but are tens to hundreds of times more effective than conventional munitions. A year's peacetime plateau production of each US PGM can be carried by a few C-5 aircraft. Surge quantities of PGMs are within US airlift capabilities, taking some of the risk out of off-shore procurement. The improving capability of antiaircraft PGMs and the escalating cost of combat aircraft (50 to 100-fold in constant dollars since WW II) may bring into question the economic viability of manned attack aircraft. The same may be true to a slightly lesser degree for heavy armored vehicles. 14 refs., 5 tabs.

53593 (UCRL-ID–105097) **Superpressure stratospheric vehicle: Final report.** Chocol, C.; Robinson, W.; Epley, L. Lawrence Livermore National Lab., CA (USA). 15 Sep 1990. 135p. Sponsored by U.S. Department of Defense. DOE Contract W-7405-ENG-48. Order Number DE91000496. Source: NTIS, PC A07/MF A01 - OSTI; GPO Dep.

Our need for wide-band global communications, earth imaging and sensing, atmospheric measurements and military reconnaissance is extensive, but growing dependence on space-based systems raises concerns about vulnerability. Military commanders require space assets that are more accessible and under local control. As a result, a robust and low cost access to space-like capability has become a national priority. Free floating buoyant vehicles in the middle stratosphere can provide the kind of cost effective access to space-like capability needed for a variety of missions. These vehicles are inexpensive, invisible, and easily launched. Developments in payload electronics, atmospheric modeling, and materials combined with improving communications and navigation infrastructure are making balloon-borne concepts more attractive. The important milestone accomplished by this project was the planned test flight over the continental United States. This document is specifically intended to review the technology development and preparations leading up to the test flight. Although the test flight experienced a payload failure just before entering its assent altitude, significant data were gathered. The results of the test flight are presented here. Important factors included in this report include quality assurance testing of the balloon, payload definition and characteristics, systems integration, preflight testing procedures, range operations, data collection, and post-flight analysis. 41 figs., 5 tabs.

53594 **Jet formation and characterization of a conical shaped charge.** Stofleth, J.H.; Owenby, R.N. pp. 355-359 of High speed photography, videography, and photonics V. Johnson, H.C. Society of Photo-Optical Instrumentation Engineers, Bellingham, WA (USA) (1987). pp. 750 (CONF-8708231–: High speed photography, videography, and photonics V, San Diego, CA (USA), 17-19 Aug 1987).

A conical shaped charge (CSC) is an explosive assembly used as a single point penetrator in applications ranging from commercial to national defense. The formation, flight characteristics, and penetration effects of the CSC are of great importance to its users. Because of the extreme velocities of the shaped charge jet, high speed documentation was necessary to research CSC effects. By use of closure switches and initial velocity studies, framing and lighting information for the Cordin 114 ultra high speed camera was determined. After the initial data was gathered, it was determined that another source of documentation was necessary. This paper reports how a 150 kilovolt flash x-ray system was implemented, enabling more accurate velocity measurements and a better understanding of jet formation and the CSC during flight.

4501 Chemical Explosions and Explosives

Refer also to citation(s) 53235, 53313

53595 (SAND–90-0528) **Far-field dispersal modeling for fuel-air-explosive devices.** Glass, M.W. Sandia National Labs., Albuquerque, NM (USA). May 1990. 71p. Sponsored by U.S. Department of Defense; U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. Order Number DE91000476. Source: NTIS, PC A04/MF A01 - OSTI; GPO Dep.

A computer model for simulating the explosive dispersal of a fuel agent in the far-field regime is described and is applied to a wide variety of initial conditions to judge their effect upon the resulting fuel/air cloud. This work was directed toward modeling the dispersal process associated with Fuel-Air-Explosives devices. The far-field dispersal regime is taken to be that time after the initial burster charge detonation in which the shock forces no longer dominate the flow field and initial canister and fuel mass breakup has occurred. The model was applied to a low vapor pressure fuel, a high vapor pressure fuel and a solid fuel. A strong dependence of the final cloud characteristics upon the initial droplet size distribution was demonstrated. The predicted fuel-air clouds were highly non-uniform in concentration. 18 refs., 86 figs., 4 tabs.

4502 Nuclear Explosions and Explosives

53596 (AD-A–224279/0/XAB) **Standard MICE/MEGS/MELT-SCENARIO plasma outputs interface. Technical report, 30 June 1988-30 June 1989.** White, W.W. Mission Research Corp., Nashua, NH (USA). 1 May 1990. 38p. Contract DNA001-88-C-0079. (MRC/NSH-N–89-002). Source: NTIS, PC A03/MF A01.

Version 1.031 of the Standard output format for plasma quantities from the MICE, MEGS, MELT, and SCENARIO codes is documented. This format defines the arrangement and file structure

used to convey quantitative information from numerical simulations of atmospheric effects generated by high-altitude nuclear explosions.

4503 Nuclear Explosion Detection

53597 (UCRL–98069) **A seismic event analyzer for nuclear test ban treaty verification.** Mason, C.L. (California Univ., Davis, CA (USA). Dept. of Applied Science); Johnson, R.R.; Searfus, R.M.; Lager, D.; Canales, T. Lawrence Livermore National Lab., CA (USA). Jan 1988. 18p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-880853–2: 3. international conference on applications of artificial intelligence in engineering, Stanford, CA (USA), 8-11 Aug 1988). Order Number DE91000817. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This paper presents an expert system that interprets seismic data from Norway's regional seismic array, NORESS, for underground nuclear weapons test ban treaty verification. Three important aspects of the expert system are (1) it emulates the problem solving behavior of the human seismic analyst using an Assumption Based Truth Maintenance System, (2) it acts as an assistant to the human analyst by automatically interpreting and presenting events for review, and (3) it enables the analyst to interactively query the system's chain of reasoning and manually perform and interpretation. The general problem of seismic treaty verification is described. The expert system is presented in terms of knowledge representation structures, assumption based reasoning system, user interface elements, and initial performance results. 8 refs., 10 figs., 2 tabs.

4504 Nuclear and Radiological Warfare

53598 (AD-A–223878/0/XAB) **Validity of the use of the neutron-reduction factor in assessing displacement damage to electronics in armoured vehicles.** Cousins, T.; Jamieson, T.J. Defence Research Establishment, Ottawa, ON (Canada). Feb 1990. 33p. (DREO–1032). Source: NTIS, PC A03/MF A01.

Abstract in English and French.

The degree of protection from neutron irradiation afforded to electronics by armoured vehicles is most currently defined by the outside-to-inside ratio of the 1 MeV equivalent neutron fluence for Silicon. It has been proposed that this factor may be approximated by an experimentally measurable parameter - the neutron (tissue kerma) reduction factor. This report examines the validity of this assumption for a variety of realistic nuclear battlefield scenarios, calculated using the computer code VPF2. In addition the response of two neutron dosimeters in the calculated fields is examined.

4505 Strategic Defense Initiative

Refer also to citation(s) 53163

53599 (AD-A–224452/3/XAB) **Beam and plasma physics research. Final report, August 1986-March 1990.** Stellingwerf, R.F.; Peterkin, R.E.; Sullivan, D.J. Mission Research Corp., Albuquerque, NM (USA). Jun 1990. 125p. Contract F29601-86-C-0216. (MRC/ABQ-R–1281). Source: NTIS, PC A06/MF A01.

Analysis was performed in high power microwave computations and theory and high energy plasma computations and theory. The HPM computations concentrated on generation, sources and propagation. Major codes used were the particle-in-cell codes SOS and ISIS. Topics studies were sources and antennas, propagation, relativistic klystron amplifiers, virtual cathode oscillators, magnetically insulated transmission lines, transvertrons and vircator phase/frequency locking. High energy plasmas were analyzed with MACH2, an implicit continuous Eulerian, arbitrary Lagrangian-Eulerian nonideal magnetohydrodynamic code. MACH2 modelled a variety of high energy plasmas including plasma flow switches, imploding liners and plasmas, compact toroids, magnetic reconnection and plasma guns. A smooth particle hydrodynamics code was developed to model various conditions, including shock heating, explosions and implosions. An optical multichannel analyzer was also provided to analyze plasma emission line spectra.

53600 (EUR–12432) **PISC II: Parametric studies. Parametric studies on the effect of defect characteristics on their detection and sizing by ultrasound.** Certo, M. (Centro Informazioni Studi Esperienze, Milan (IT)); Cola, T.; Mariani, G. Commission of the European Communities, Luxembourg (Luxembourg). Sep 1989. 41p. Contract No. 2861-85-12 EN ISP - 1. Source: NTIS (US Sales Only), PC A03/MF A01.

This report describes the experimental results of the characterization of the ultrasonic response produced by planar diffusion welded defects, inspected with the pulse-echo technique with probes at angles of inclination of 45^0, 60^0 and 70^0. In particular the amplitude and time locus curves for orthogonal scanning lines at the defect plane and passing through its middle have been determined. In general a diffuse presence of effects linked to mode conversion phenomena of the ultrasonic wave incident on the defect was observed, which in many cases made interpretation of the results more complicated. For the embedded vertical defects (tilt angle equal to zero) it was possible to determine the curves giving the echo maximum amplitude as a function of the defect depth. These curves have a regular behaviour which follows the line of the DAC curve quite well. Even for surface defects which can be detected by the corner effect, one finds quite regular behaviour as a function of the various parameters (defect height, probe angle, tilt angle), while it is more complicated to interpret the results for the embedded inclined defects (tilt angle different from zero), probably because of the different contributions of the mode conversion phenomena in the individual cases.

53601 **Strategic defense panel discussion.** Duarte, F.J. (Eastman Kodak Co. (US)); Bray, C.A.; Gullickson, R.L.; Johnson, K.; Teller, E.; Meyer, T.; Miller, J.; Patel, K.; Scully, M.O.; Wilson, L. pp. 1135-1155 of Lasers '89. Harris, D.G.; Shay, T.M. STS Press, McLean, VA (USA) (1990). pp. 1159 (CONF-891261–: Lasers '89: 12th international conference on lasers and applications, New Orleans, LA (USA), 3-8 Dec 1989).

This paper discusses the various advancements made in laser technology, design and uses. Specifically discussed are military applications of x-ray lasers, strategic defense initiative and energy spectra. National research programs regarding this work are reviewed.

4506 Chemical and Biological

Refer also to citation(s) 53192

53602 (ORNL/TM–11354) **Chemical Stockpile Disposal Program rapid accident assessment.** Chester, C.V. Oak Ridge National Lab., TN (USA). Aug 1990. 94p. Sponsored by U.S. Department of Defense. DOE Contract AC05-84OR21400. Order Number DE91001010. Source: NTIS, PC A05/MF A01 - OSTI; GPO Dep.

This report develops a scheme for the rapid assessment of a release of toxic chemicals resulting from an accident in one of the most chemical weapon demilitarization plants or storage areas. The system uses such inputs as chemical and pressure sensors monitoring the plant and reports of accidents radioed to the Emergency Operations Center by work parties or monitoring personnel. A size of release can be estimated from previous calculations done in the risk analysis, from back calculation from an open-air chemical sensor measurement, or from an estimated percentage of the inventory of agent at the location of the release. Potential consequences of the estimated release are calculated from real-time meteorological data, surrounding population data, and properties of the agent. In addition to the estimated casualties, area coverage and no-death contours vs time would be calculated. Accidents are assigned to one of four categories: community emergencies, which are involve a threat to off-site personnel; on-post emergencies, which involve a threat only to on-site personnel; advisory, which involves a potential for threat to on-site personnel; and chemical occurrence, which can produce an abnormal operating condition for the plant but no immediate threat to on-site personnel. 9 refs., 20 tabs.

53603 (ORNL/TM–11412) **Decision making technical support study for the US Army's Chemical Stockpile Disposal Program: Enhancing command, control, and computer operations at Aberdeen Proving Ground and Pine Bluff Arsenal.** Feldman, D.L.; Dobson, J.E. Oak Ridge National Lab., TN (USA).

Aug 1990. 88p. Sponsored by U.S. Department of Defense. DOE Contract AC05-84OR21400. Order Number DE91001020. Source: NTIS, PC A06/MF A01 - OSTI; GPO Dep.

This report examines the adequacy of current command and control systems designed to make timely decisions that would enable sufficient warning and protective response to an accident at the Edgewood area of Aberdeen Proving Ground (APG), Maryland, and at Pine Bluff Arsenal (PBA), Arkansas. Institutional procedures designed to facilitate rapid accident assessment, characterization, warning, notification, and response after the onset of an emergency and computer-assisted decision-making aids designed to provide salient information to on- and-off-post emergency responders are examined. The character of emergency decision making at APG and PBA, as well as potential needs for improvements to decision-making practices, procedures, and automated decision-support systems (ADSSs), are described and recommendations are offered to guide equipment acquisition and improve on- and off-post command and control relationships. We recommend that (1) a continued effort be made to integrate on- and off-post command control, and decision-making procedures to permit rapid decision making; (2) the pathways for alert and notification among on- and off-post officials be improved and that responsibilities and chain of command among off-post agencies be clarified; (3) greater attention be given to organizational and social context factors that affect the adequacy of response and the likelihood that decision-making systems will work as intended; and (4) faster improvements be made to on-post ADSSs being developed at APG and PBA, which hold considerable promise for depicting vast amounts of information. Phased development and procurement of computer-assisted decision-making tools should be undertaken to balance immediate needs against available resources and to ensure flexibility, equity among sites, and compatibility among on- and off-post systems. 112 refs., 6 tabs.

54 ENVIRONMENTAL SCIENCES

Refer also to citation(s) 52724

53604 (DOE/EH/OEV–03P) **Environmental Survey preliminary report, Rocky Flats Plant, Golden, Colorado.** USDOE Assistant Secretary for Environment, Safety, and Health, Washington, DC (USA). Office of Environmental Audit. Jun 1987. 327p. Sponsored by U.S. DOE Environment Health & Safety. DOE Contract AC01-87EH79003. Order Number DE91001092. Source: NTIS, PC A15/MF A01; OSTI; INIS; GPO Dep.

This report presents the preliminary findings of the Environmental Survey of the United States Department of Energy (DOE), Rocky Flats Plant (RFP), conducted August 11 through 22, 1986. The Survey is being conducted by an multidisciplinary team of environmental specialists, led and managed by the Office of Environment, Safety and Health's Office of Environmental Audit. Individual team members are outside experts supplied by a private contractor. The objective of the Survey is to identify environmental problems and areas of environmental risk associated with the RFP. The Survey covers all environmental media and all areas of environmental regulations. It is being performed in accordance with the DOE Environmental Survey Manual. The on-site phase of the Survey involves the review of existing site environmental data observations of the operations carried on at RFP, and interviews with site personnel. The Survey team developed a Sampling and Analysis Plan to assist in further assessing certain environmental problems identified during its on-site activates. The Sampling and Analysis Plan is being executed by DOE's Oak Ridge National Laboratory. When completed, the results will be incorporated into the RFP Environmental Survey Interim Report. The Interim Report will reflect the final determinations of the RFP Survey. 75 refs., 24 figs., 33 tabs.

53605 (DOE/EH/OEV–04P) **Environmental Survey preliminary report, Portsmouth Uranium Enrichment Complex, Piketon, Ohio.** USDOE Assistant Secretary for Environment, Safety, and Health, Washington, DC (USA). Office of Environmental Audit. Aug 1987. 255p. Sponsored by U.S. DOE Environment Health & Safety. DOE Contract AC01-87EH79003. Order Number DE91002504. Source: NTIS, PC A12/MF A01; OSTI; INIS; GPO Dep.

This report presents the preliminary findings from the first phase of the Environmental Survey of the United States Department of Energy (DOE) Portsmouth Uranium Enrichment Complex (PUEC), conducted August 4 through August 15, 1986. The Survey is being conducted by an interdisciplinary team of environmental specialists, led and managed by the Office of Environment, Safety and Health's Office of Environmental Audit. Team specialists are being supplied by a private contractor. The objective of the Survey is to identify environmental problems and areas of environmental regulation. It is being performed in accordance with the DOE Environmental Survey Manual. This phase of the Survey involves the review of existing site environmental data, observations of the operations performed at PUEC, and interviews with site personnel. The Survey team developed a Sampling and Analysis Plan to assist in further assessing certain of the environmental problems identified during its on-site activities. The Sampling and Analysis Plan will be executed by Argonne National Laboratory. When completed, the results will be incorporated into the PUEC Environmental Survey Interim Report. The Interim Report will reflect the final determinations of the PUEC Survey. 55 refs., 22 figs., 21 tabs.

53606 (DOE/EH/OEV–05P) **Environmental Survey preliminary report, Hanford Site, Richland, Washington.** USDOE Assistant Secretary for Environment, Safety, and Health, Washington, DC (USA). Office of Environmental Audit. Aug 1987. 480p. Sponsored by U.S. DOE Environment Health & Safety. DOE Contract AC01-87EH79003. Order Number DE91001067. Source: NTIS, PC A21/MF A01; OSTI; INIS; GPO Dep.

This report presents the preliminary findings from the first phase of the Environmental Survey of the United States Department of Energy (DOE) Hanford Site, conducted August 18 through September 5, 1986. The Survey is being conducted by an interdisciplinary team of environmental specialists, led and managed by the Office of Environment, Safety and Health's Office of Environmental Audit. Individual team components are being supplied by a private contractor. The objective of the Survey is to identify environmental problems and areas of environmental risk associated with the Hanford Site. The Survey covers all environmental media and all areas of environmental regulation. It is being performed in accordance with the DOE Environmental Survey Manual. This phase of the Survey involves the review of existing site environmental data, observations of the operations carried on at the Hanford Site, and interviews with site personnel. The Survey team developed a Sampling and Analysis Plan to assist in further assessing certain of the environmental problems identified during its on-site activities. The Sampling and Analysis Plan will be executed by a DOE National Laboratory or a support contractor. When completed, the results will be incorporated into the Environmental Survey Interim Report for the Hanford Site. The Interim Report will reflect the final determinations of the Hanford Site Survey. 44 refs., 88 figs., 74 tabs.

53607 (DOE/EH/OEV–06P) **Environmental Survey preliminary report, Pantex Facility, Amarillo, Texas.** USDOE Assistant Secretary for Environment, Safety, and Health, Washington, DC (USA). Office of Environmental Audit. Sep 1987. 292p. Sponsored by U.S. DOE Environment Health & Safety. DOE Contract AC01-87EH79003. Order Number DE91001073. Source: NTIS, PC A13/MF A01; OSTI; INIS; GPO Dep.

This report presents the preliminary findings from the first phase of the Environmental Survey of the United States Department of Energy (DOE) Pantex Facility, conducted November 3 through 14, 1986.The Survey is being conducted by an interdisciplinary team of environmental specialist, led and managed by the Office of Environment, Safety and Health's Office of Environmental Audit. Individual team components are outside experts being supplied by a private contractor. The objective of the Survey is to identify environmental problems and areas of environmental risk associated with the Pantex Facility. The Survey covers all environmental media and all areas of environmental regulation. It is being performed in accordance with the DOE Environmental Survey Manual. The on-site phase of the Survey involves the review of existing site environmental data, observations of the operations carried on at the Pantex Facility, and interviews with site personnel. The Survey

team developed a Sampling and Analysis Plan to assist in further assessing certain of the environmental problems identified during its on-site activities. The Sampling and Analysis Plan will be executed by the Oak Ridge National Laboratory. When completed, the results will be incorporated into the Pantex Facility Environmental Survey Interim Report. The Interim Report will reflect the final determinations of the Survey for the Pantex Facility. 65 refs., 44 figs., 27 tabs.

53608 (DOE/EH/OEV–07P) **Environmental Survey preliminary report, Y-12 Plant, Oak Ridge, Tennessee.** USDOE Assistant Secretary for Environment, Safety, and Health, Washington, DC (USA). Office of Environmental Audit. Nov 1987. 627p. Sponsored by U.S. DOE Environment Health & Safety. DOE Contract AC01-87EH79003. Order Number DE91002512. Source: NTIS, PC A99/MF A01; OSTI; INIS; GPO Dep.

This report presents the preliminary findings from the first phase of the Environmental Survey of the Department of Energy (DOE), Y-12 Plant, conducted November 10 through 21 and December 9 through 11, 1986. This Survey is being conducted by a multidisciplinary team of environmental specialists, led and managed by the Office of Environment, Safety and Health's Office of Environmental Audit. Individual team members are outside experts being supplied by a private contractor. The objective of the Survey is to identify environmental problems and areas of environmental risk associated with the Y-12 Plant. The Survey covers all environmental media and all areas of environmental regulation. It is being performed in accordance with the DOE Environmental Survey Manual. This phase of the Survey involves the review of existing site environmental data, observations of the operations performed at Y-12, and interviews with site personnel. The Survey team developed a Sampling and Analysis Plan to assist in further assessing certain environmental problems identified during its on-site activities. The Sampling and Analysis Plan is being executed by DOE's Argonne National Laboratory. When completed, the results will be incorporated into the Y-12 Plant Environmental Survey Interim Report. The Interim Report will reflect the final determinations of the Y-12 Plant Survey. 80 refs., 76 figs., 61 tabs.

53609 (DOE/EH/OEV–09P) **Environmental Survey preliminary report, Lawrence Livermore National Laboratory, Livermore, California.** USDOE Assistant Secretary for Environment, Safety, and Health, Washington, DC (USA). Office of Environmental Audit. Dec 1987. 347p. Sponsored by U.S. DOE Environment Health & Safety. DOE Contract AC01-87EH79003. Order Number DE91001074. Source: NTIS, PC A15/MF A01 - OSTI; GPO Dep.

This report presents the preliminary findings from the first phase of the Environmental Survey of the Department of Energy (DOE) Lawrence Livermore National Laboratory (LLNL), conducted December 1 through 19, 1986. The Survey is being conducted by an interdisciplinary team of environmental specialists, led and managed by the Office of Environment, Safety and Health's Office of Environmental Audit. Individual team components are being supplied by a private contractor. The objective of the Survey is to identify environmental problems and areas of environmental risk associated with LLNL. The Survey covers all environmental media all areas of environmental regulation. It is being performed in accordance with the DOE Environmental Survey Manual. This phase of the Survey involves the review of existing site environmental data, observations of the operations performed at LLNL, and interviews with site personnel. A Sampling and Analysis Plan was developed to assist in further assessing certain of the environmental problems identified during performance of on-site activities. The Sampling and Analysis Plan will be executed by a DOE National Laboratory. When completed, the results will be incorporated into the LLNL Environmental Survey Interim Report. The Interim Report will reflect the final determinations of the LLNL Survey. 70 refs., 58 figs., 52 tabs.,

53610 (DOE/EH/OEV–12P) **Environmental Survey preliminary report, Los Alamos National Laboratory, Los Alamos, New Mexico.** USDOE Assistant Secretary for Environment, Safety, and Health, Washington, DC (USA). Office of Environmental Audit. Jan 1988. 587p. Sponsored by U.S. DOE Environment Health & Safety. DOE Contract AC01-87EH79003. Order Number DE91002506. Source: NTIS, PC A25/MF A01; OSTI; INIS; GPO Dep.

This report presents the preliminary findings from the first phase of the Environmental Survey of the United States Department of Energy's (DOE) Los Alamos National Laboratory (LANL), conducted March 29, 1987 through April 17, 1987. The Survey is being conducted by an interdisciplinary team of environmental specialists, led and managed by the Office of Environment, Safety and Health's Office of Environmental Audit. Individual team components are outside experts being supplied by a private contractor. The objective of the Survey is to identify environmental problems and areas of environmental risk associated with the LANL. The Survey covers all environmental media and all areas of environmental regulation. It is being performed in accordance with the DOE Environmental Survey Manual. The on-site phase of the Survey involves the review of existing site environmental data, observations of the operations carried on at the LANL, and interviews with site personnel. The Survey team developed Sampling and Analysis Plan to assist in further assessing certain of the environmental problems identified during its on-site activities. The Sampling and Analysis Plan will be executed by the Idaho National Engineering Laboratory. When completed, the results will be incorporated into the LANL Environmental Survey Interim Report. The Interim Report will reflect the final determinations of the Survey for the LANL. 65 refs., 68 figs., 73 tabs.

53611 (DOE/EH/OEV–13P) **Environmental Survey preliminary report, Pinellas Plant, Largo, Florida.** USDOE Assistant Secretary for Environment, Safety, and Health, Washington, DC (USA). Office of Environmental Audit. Nov 1987. 369p. Sponsored by U.S. DOE Environment Health & Safety. DOE Contract AC01-87EH79003. Order Number DE91001062. Source: NTIS, PC A16/MF A01; OSTI; INIS; GPO Dep.

The purpose of this report is to present the preliminary findings made during the Environmental Survey, conducted May 11 through 22, 1987, at the United States Department of Energy (DOE) Pinellas Plant in Largo, Florida. As a Preliminary Report, the contents are subject to revisions, which will be made in a forthcoming Interim Report, based on Albuquerque Operations Office review and comments on technical accuracy, the results of the sampling and analyses, and other information that may come to the Survey team's attention prior to issuance of the Interim Report. The Pinellas Plant is currently operated for DOE by the General Electric Company-Neutron Devices Department (GENDD). The Pinellas Survey is part of the larger DOE-wide Environmental Survey effort announced by Secretary John S. Herrington on September 18, 1985. The purpose of this effort is to identify, via "no fault" baseline Surveys, existing environmental problems are areas of environmental risk at DOE facilities and to rank them on a DOE-wide basis. This ranking will enable DOE to more effectively establish priorities for addressing environmental problems and allocate the resources necessary to correct these problems. Because the Survey is "no fault" and is not an "audit," it is not designed to identify specific isolated incidents of noncompliance or to analyze environmental management practices. Such incidents and/or management practices will, however, be used in the Survey as a means of identifying existing and potential environmental problems. 55 refs., 37 figs., 37 tabs.

53612 (DOE/EH/OEV–14P) **Environmental Survey preliminary report, Brookhaven National Laboratory, Upton, New York.** USDOE Assistant Secretary for Environment, Safety, and Health, Washington, DC (USA). Office of Environmental Audit. Jun 1988. 319p. Sponsored by U.S. DOE Environment Health & Safety. DOE Contract AC01-87EH79003. Order Number DE91002503. Source: NTIS, PC A14/MF A01; OSTI; INIS; GPO Dep.

This report presents the preliminary findings from the first phase of the Environmental Survey of the United States Department of Energy (DOE) Brookhaven National Laboratory (BNL) conducted April 6 through 17, 1987. The Survey is being conducted by an interdisciplinary team of environmental specialists, led and managed by the Office of Environment, Safety and Health's Office of Environmental Audit. Individual team components are being supplied by a private contractor. The objective of the Survey is to identify environmental problems and areas of environmental risk associated with

BNL. The Survey covers all environmental media and all areas of environmental regulation. It is being performed in accordance with the DOE Environmental Survey Manual. This phase of the Survey involves the review of existing site environmental data, observations of the operations carried on at BNL, and interviews with site personnel. The Survey team developed a Sampling and Analysis Plan to assist in further assessing specific environmental problems identified during its on-site activities. The Sampling and Analysis Plan will be executed by Oak Ridge National Laboratory. When completed, the results will be incorporated into the BNL Environmental Survey Interim Report. The Interim Report will reflect the final determinations of the BNL Survey. 80 refs., 24 figs., 48 tabs.

53613 (DOE/EH/OEV–15P) **Environmental Survey preliminary report, Nevada Test Site, Mercury, Nevada.** USDOE Assistant Secretary for Environment, Safety, and Health, Washington, DC (USA). Office of Environmental Audit. Apr 1988. 477p. Sponsored by U.S. DOE Environment Health & Safety. DOE Contract AC01-87EH79003. Order Number DE91002499. Source: NTIS, PC A21/MF A01; OSTI; INIS; GPO Dep.

This report presents the preliminary findings from the first phase of the Environmental Survey of the United States Department of Energy (DOE) Nevada Test Site (NTS), conducted June 22 through July 10, 1987. The Survey is being conducted by a multidisciplinary team of environmental specialists led and managed by the Office of Environment, Safety and Health's Office of Environmental Audit. Individual team members are outside experts being supplied by a private contractor. The objective of the Survey is to identify environmental problems and areas of environmental risk associated with the NTS. The Survey covers all environment media and all areas of environmental regulation. It is being performed in accordance with the DOE Environmental Survey Manual. This phase of the Survey involves the review of existing site environmental data, observations of the operations and activities performed at the NTS, and interviews with site personnel. The Survey team developed a Sampling and Analysis Plan to assist in further assessing certain environmental problems identified during its on-site activities. The Sampling and Analysis Plan is being executed by the Battelle Columbus Division under contract with DOE. When completed, the results will be incorporated into the NTS Environmental Survey Interim Report. The Interim Report will reflect the final determinations of the NTS Survey. 165 refs., 42 figs., 52 tabs.

53614 (DOE/EH/OEV–16P) **Environmental Survey preliminary report, Fermi National Accelerator Laboratory, Batavia, Illinois.** USDOE Assistant Secretary for Environment, Safety, and Health, Washington, DC (USA). Office of Environmental Audit. Oct 1988. 246p. Sponsored by U.S. DOE Environment Health & Safety. DOE Contract AC01-87EH79003. Order Number DE91001066. Source: NTIS, PC A11/MF A01; OSTI; INIS; GPO Dep.

This report presents the preliminary findings from the first phase of the Environmental Survey of the US Department of Energy (DOE) Fermi National Accelerator Laboratory (Fermilab), conducted September 14 through 25, 1987. The Survey is being conducted by an interdisciplinary team of environmental specialists led and managed by the Office of Environment, Safety and Health's Office of Environmental Audit. Individual participants for the Survey team are being supplied by a private contractor. The objective of the Survey is to identify environmental problems and areas of environmental risk associated with Fermilab. The Survey covers all environmental media and all areas of environmental regulation. It is being performed in accordance with the DOE Environmental Survey Manual. This phase of the Survey involves the review of existing site environmental data, observations of the operations performed at Fermilab, and interviews with site personnel. 110 refs., 26 figs., 41 tabs.

53615 (DOE/EH/OEV–17P) **Environmental Survey preliminary report, Argonne National Laboratory, Argonne, Illinois.** USDOE Assistant Secretary for Environment, Safety, and Health, Washington, DC (USA). Office of Environmental Audit. Nov 1988. 329p. Sponsored by U.S. DOE Environment Health & Safety. DOE Contract AC01-87EH79003. Order Number DE91001063. Source: NTIS, PC A15/MF A01; OSTI; INIS; GPO Dep.

This report presents the preliminary findings of the first phase of the Environmental Survey of the United States Department of Energy's (DOE) Argonne National Laboratory (ANL), conducted June 15 through 26, 1987. The Survey is being conducted by an interdisciplinary team of environmental specialists, led and managed by the Office of Environment, Safety and Health's Office of Environmental Audit. The team includes outside experts supplied by a private contractor. The objective of the Survey is to identify environmental problems and areas of environmental risk associated with ANL. The Survey covers all environmental media and all areas of environmental regulation. It is being performed in accordance with the DOE Environmental Survey Manual. The on-site phase of the Survey involves the review of existing site environmental data, observations of the operations carried on at ANL, and interviews with site personnel. The Survey team developed a Sampling and Analysis (S&A) Plan to assist in further assessing certain of the environmental problems identified during its on-site activities. The S&A Plan will be executed by the Oak Ridge National Laboratory (ORNL). When completed, the S&A results will be incorporated into the Argonne National Laboratory Environmental Survey findings for inclusion in the Environmental Survey Summary Report. 75 refs., 24 figs., 60 tabs.

53616 (DOE/EH/OEV–19P) **Environmental Survey preliminary report, Princeton Plasma Physics Laboratory, Princeton, New Jersey.** USDOE Assistant Secretary for Environment, Safety, and Health, Washington, DC (USA). Office of Environmental Audit. May 1989. 214p. Sponsored by U.S. DOE Environment Health & Safety. DOE Contract AC01-87EH79003. Order Number DE91001064. Source: NTIS, PC A10/MF A01; OSTI; INIS; GPO Dep.

This report presents the preliminary findings of the first phase of the Environmental Survey of the United States Department of Energy's (DOE) Princeton Plasma Physics Laboratory (PPPL), conducted June 13 through 17, 1988. The Survey is being conducted by an interdisciplinary team of environmental specialists, led and managed by the Office of Environment, Safety and Health's Office of Environmental Audit. Team members are being provided by private contractors. The objective of the Survey is to identify environmental problems and areas of environmental risk associated with PPPL. The Survey covers all environmental media and all areas of environmental regulation. It is being performed in accordance with the DOE Environmental Survey Manual. This phase of the Survey involves the review of existing site environmental data, observations of the operations carried on at PPPL, and interviews with site personnel. The Survey team developed a Sampling and Analysis (S&A) Plan to assist in further assessing certain of the environment problems identified during its on-site activities. The S&A plan is being developed by the Idaho National Engineering Laboratory. When completed, the S&A results will be incorporated into the PPPL Survey findings for inclusion in the Environmental Survey Summary Report. 70 refs., 17 figs., 21 tabs.

53617 (DOE/EH/OEV–20P) **Environmental Survey preliminary report, Paducah Gaseous Diffusion Plant, Paducah, Kentucky.** USDOE Assistant Secretary for Environment, Safety, and Health, Washington, DC (USA). Office of Environmental Audit. Jan 1989. 365p. Sponsored by U.S. DOE Environment Health & Safety. DOE Contract AC01-87EH79003. Order Number DE91002501. Source: NTIS, PC A16/MF A01; OSTI; INIS; GPO Dep.

This report presents the preliminary findings from the first phase of the Environmental Survey of the United States Department of Energy (DOE) Paducah Gaseous Diffusion Plant (PGDP) conducted November 30 through December 11, 1987. The Survey is being conducted by an interdisciplinary team of environmental specialists, led and managed by the Office of Environment, Safety and Health's Office of Environmental Audit. Individual team components are being supplied by a private contractor. The objective of the Survey is to identify environmental problems and areas of environmental risk associated with PGDP. The Survey covers all environmental media and all areas of environmental regulation. It is being performed in accordance with the DOE Environmental Survey Manual. This phase of the Survey involves the review of existing site environmental data, observations of the operations

carried on at PGDP, and interviews with site personnel. The Survey team developed a Sampling and Analysis Plan to assist in further assessing certain of the environmental problems identified during its on-site activities. The Sampling and Analysis Plan will be executed by Idaho National Engineering Laboratory. When completed, the results will be used to modify the preliminary findings. 160 refs., 33 figs., 53 tabs.

53618 (DOE/EH/OEV–21P) **Environmental Survey preliminary report, Morgantown Energy Technology Center, Morgantown, West Virginia.** USDOE Assistant Secretary for Environment, Safety, and Health, Washington, DC (USA). Office of Environmental Audit. Jun 1988. 305p. Sponsored by U.S. DOE Environment Health & Safety. DOE Contract AC01-87EH79003. Order Number DE91001091. Source: NTIS, PC A14/MF A01 - OSTI; GPO Dep.

This report presents the preliminary findings from the first phase of the Environmental Survey of the US Department of Energy (DOE) Morgantown Energy Technology Center (METC) conducted November 30 through December 4, 1987. In addition, the preliminary findings of the Laramie Project Office (LPO) Survey, which was conducted as part of the METC Survey on January 25 through 29, 1988, are presented in Appendices E and F. The Survey is being conducted by an interdisciplinary team of environmental specialists, led and managed by the Office of Environment Safety and Health's Office of Environmental Audit. Individual team components are outside experts being supplied by a private contractor. The objective of the Survey is to identify environmental problems and areas of environmental risk associated with METC. The Survey covers all environmental media and all areas of environmental regulation. It is being performed in accordance with the DOE Environmental Survey Manual. The on-site phase of the Survey involves the review of existing site environmental data, observations of the operations carried on at METC, and interviews with site personnel. The Survey team developed a Sampling and Analysis Plan to assist in further assessing certain environmental problems identified during its on-site activities at METC. The Sampling and Analysis Plan will be executed by the Oak Ridge National Laboratory (ORNL). When completed, the results will be incorporated into the METC Environmental Survey Interim Report. The Interim Report will reflect the final determinations of the Survey METC. 60 refs., 28 figs., 43 tabs.

53619 (DOE/EH/OEV–22P) **Environmental Survey preliminary report, Idaho National Engineering Laboratory, Idaho Falls, Idaho and Component Development and Integration Facility, Butte, Montana.** USDOE Assistant Secretary for Environment, Safety, and Health, Washington, DC (USA). Office of Environmental Audit. Sep 1988. 669p. Sponsored by U.S. DOE Environment Health & Safety. DOE Contract AC01-87EH79003. Order Number DE91001071. Source: NTIS, PC A99/MF A01; OSTI; INIS; GPO Dep.

This report presents the preliminary findings of the first phase of the Environmental Survey of the United States Department of Energy's (DOE) Idaho National Engineering Laboratory (INEL) and Component Development and Integration Facility (CDIF), conducted September 14 through October 2, 1987. The Survey is being conducted by an interdisciplinary team of environmental specialists, led and managed by the Office of Environment, Safety and Health's Office of Environmental Audit. The team includes outside experts supplied by a private contractor. The objective of the Survey is to identify environmental problems and areas of environmental risk associated with the INEL and CDIF. The Survey covers all environmental media and all areas of environmental regulation. It is being performed in accordance with the DOE Environmental Survey Manual. The on-site phase of the Survey involves the review of existing site environmental data, observations of the operations' carried on at the INEL and the CDIF, and interviews with site personnel. The Survey team developed a Sampling and Analysis (S&A) Plan to assist in further assessing certain of the environmental problems identified during its on-site activities. The S&A Plan will be executed by the Oak Ridge National Laboratory. When completed, the S&A results will be incorporated into the INEL/CDIF Survey findings for inclusion into the Environmental Survey Summary Report. 90 refs., 95 figs., 77 tabs.

53620 (DOE/EH/OEV–23P) **Environmental Survey preliminary report, Lawrence Berkeley Laboratory, Berkeley, California.** USDOE Assistant Secretary for Environment, Safety, and Health, Washington, DC (USA). Office of Environmental Audit. Jul 1988. 310p. Sponsored by U.S. DOE Environment Health & Safety. DOE Contract AC01-87EH79003. Order Number DE91002500. Source: NTIS, PC A14/MF A01; OSTI; INIS; GPO Dep.

The purpose of this report is to present the preliminary findings made during the Environmental Survey, February 22–29, 1988, at the US Department of Energy (DOE) Lawrence Berkeley Laboratory (LBL) in Berkeley, California. The University of California operates the LBL facility for DOE. The LBL Survey is part of the larger DOE-wide Environmental Survey announced by Secretary John S. Herrington on September 18, 1985. The purpose of this effort is to identify, via "no fault" baseline Surveys, existing environmental problems and areas of environmental risk at DOE facilities, and to rank them on a DOE wide basis. This ranking will enable DOE to more effectively establish priorities for addressing environmental problems and allocate the resources necessary to correct them. Because the Survey is "no fault" and is not an "audit," it is not designed to identify specific isolated incidents of noncompliance or to analyze environmental management practices. Such incidents and/or management practices will, however, be used in the Survey as a means of identifying existing and potential environmental problems. The LBL Survey was conducted by a multidisciplinary team of technical specialists headed and managed by a Team Leader and Assistant Team Leader from DOE's Office of Environmental Audit. A complete list of the LBL Survey participants and their affiliations is provided in Appendix A. 80 refs., 27 figs., 37 tabs.

53621 (DOE/EH/OEV–24P) **Environmental Survey preliminary report, Solar Energy Research Institute, Golden, Colorado.** USDOE Assistant Secretary for Environment, Safety, and Health, Washington, DC (USA). Office of Environmental Audit. Oct 1988. 194p. Sponsored by U.S. DOE Environment Health & Safety. DOE Contract AC01-87EH79003. Order Number DE91002510. Source: NTIS, PC A09/MF A01 - OSTI; GPO Dep.

This report presents the preliminary findings of the first phase of the Environmental Survey of the US Department of Energy's (DOE) Solar Energy Research Institute (SERI), conducted December 14 through 18, 1987. The Survey is being conducted by an interdisciplinary team of environmental specialists, led and managed by the Office of Environment, Safety and Health's Office of Environmental Audit. The team includes outside experts supplied by private contractors. The objective of the Survey is to identify environmental problems and areas of environmental risk associated with SERI. The Survey covers all environmental media and all areas of environmental regulation. It is being performed in accordance with the DOE Environmental Survey Manual. The on-site phase of the Survey involves the review of existing site environmental data, observations of the operations carried on at SERI, and interviews with site personnel. 33 refs., 22 figs., 21 tabs.

53622 (DOE/EH/OEV–25P) **Environmental Survey preliminary report, Naval Petroleum Reserves in California (NPRC), Tupman, California.** USDOE Assistant Secretary for Environment, Safety, and Health, Washington, DC (USA). Office of Environmental Audit. Feb 1989. 286p. Sponsored by U.S. DOE Environment Health & Safety. DOE Contract AC01-87EH79003. Order Number DE91001088. Source: NTIS, PC A13/MF A01 - OSTI; GPO Dep.

This report presents the preliminary environmental findings from the first phase of the Environmental Survey of the US Department of Energy (DOE) Naval Petroleum Reserves 1 (NPR-1) and 2 (NPR-2) in California (NPRC), conducted May 9–20, 1988. The Survey is being conducted by an interdisciplinary team of environmental specialists, led and managed by the Office of Environment Safety and Health's Office of Environmental Audit. Individual team specialists are outside experts being supplied by a private contractor. The objective of the Survey is to identify environmental problems and areas of environmental risk associated with NPRC. The Survey covers all environmental media and all areas of environmental regulation. It is being performed in accordance with the DOE Environmental Survey Manual. The on-site phase of the

Survey involved the review of existing site environmental data, observations of the operations carried on at NPRC, and interviews with site personnel. 120 refs., 28 figs., 40 tabs.

53623 (DOE/EH/OEV–26P) **Environmental Survey preliminary report, Oak Ridge Gaseous Diffusion Plant, Oak Ridge, Tennessee.** USDOE Assistant Secretary for Environment, Safety, and Health, Washington, DC (USA). Office of Environmental Audit. Feb 1989. 403p. Sponsored by U.S. DOE Environment Health & Safety. DOE Contract AC01-87EH79003. Order Number DE91002505. Source: NTIS, PC A18/MF A01; OSTI; INIS; GPO Dep.

This report presents the preliminary findings from the first phase of the Environmental Survey of the US Department of Energy's (DOE) Oak Ridge Gaseous Diffusion Plant (ORGDP) conducted March 14 through 25, 1988. The Survey is being conducted by an interdisciplinary team of environmental specialists, led and managed by the Office of Environment, Safety and Health's Office of Environmental Audit. Individual team components are being supplied by a private contractor. The objective of the Survey is to identify environmental risk associated with ORGDP. The Survey covers all environmental media and all areas of environmental regulation. It is being performed in accordance with the DOE Environmental Survey Manual. This phase of the Survey involves the review of existing site environmental data, observations of the operations carried on at ORGDP, and interviews with site personnel. The Survey team developed a Sampling and Analysis Plan to assist in further assessing certain of the environmental problems identified during is on-site activities. The Sampling and Analysis Plan will be executed by Idaho National Engineering Laboratory (INEL). When completed, the results will be incorporated into the ORGDP Survey findings for in inclusion into the Environmental Survey Summary Report. 120 refs., 41 figs., 74 tabs.

53624 (DOE/EH/OEV–27P) **Environmental Survey preliminary report, Pittsburgh Energy Technology Center, Pittsburgh, Pennsylvania.** USDOE Assistant Secretary for Environment, Safety, and Health, Washington, DC (USA). Office of Environmental Audit. Sep 1988. 190p. Sponsored by U.S. DOE Environment Health & Safety. DOE Contract AC01-87EH79003. Order Number DE91001065. Source: NTIS, PC A09/MF A01 - OSTI; GPO Dep.

This report presents the preliminary findings from the first phase of the Environmental Survey of the US Department of Energy (DOE) Pittsburgh Energy Technology Center (PETC) conducted December 7–11, 1987. The Survey is being conducted by an interdisciplinary team of environmental specialists, led and managed by the Office of Environment, Safety and Health's Office of Environmental Audit. Individual team specialists are outside experts being supplied by a private contractor. The objective of the Survey is to identify environmental problems and areas of environmental risk associated with PETC. The Survey covers all environmental media and all areas of environmental regulation. It is being performed in accordance with the DOE Environmental Survey Manual. This phase of the Survey involves the review of existing site environmental data, observations of the operations carried on at PETC, and interviews with site personnel. The Survey team developed a Sampling and Analysis (S&A) Plan to assist in further assessing certain environmental problems identified during its on-site Survey activities at PETC. The S&A Plan will be executed by the Oak Ridge National Laboratory (ORNL). When completed, the Plan's results will be incorporated into the PETC Survey findings for inclusion into the Environmental Survey Summary Report. 64 refs., 23 figs., 29 tabs.

53625 (DOE/EH/OEV–28P) **Environmental Survey preliminary report, Laboratory for Energy-Related Health Research, Davis, California.** USDOE Assistant Secretary for Environment, Safety, and Health, Washington, DC (USA). Office of Environmental Audit. Mar 1988. 229p. Sponsored by U.S. DOE Environment Health & Safety. DOE Contract AC01-87EH79003. Order Number DE91001072. Source: NTIS, PC A11/MF A01; OSTI; INIS; GPO Dep.

This report presents the preliminary findings from the first phase of the Survey of the United States Department of Energy (DOE) Laboratory for Energy-Related Health Research (LEHR) at the University of California, Davis (UC Davis), conducted November 16 through 20, 1987. The Survey is being conducted by an interdisciplinary team of environmental specialists, led and managed by the Office of Environment, Safety and Health's Office of Environmental Audit. Individual team components are being supplied by a private contractor. The objective of the Survey is to identify environmental problems and areas of environmental risk associated with the LEHR. The Survey covers all environmental media and all areas of environmental regulation, and is being performed in accordance with the DOE Environmental Survey Manual. This phase of the Survey involves the review of existing site environmental data, observations of the operations at the LEHR and interviews with site personnel. The Survey team developed a Sampling and Analysis Plan to assist in further assessing certain of the environmental problems identified during its on-site activities. The Sampling and Analysis Plan will be executed by a DOE National Laboratory or a support contractor. When completed, the results will be incorporated into the Environmental Survey Interim Report for the LEHR at UC Davis. The Interim Report will reflect the final determinations of the LEHR Survey. 75 refs., 26 figs., 23 tabs.

53626 (DOE/EH/OEV–31P) **Environmental Survey preliminary report, Oak Ridge National Laboratory (X-10), Oak Ridge, Tennessee.** USDOE Assistant Secretary for Environment, Safety, and Health, Washington, DC (USA). Office of Environmental Audit. Jul 1988. 448p. Sponsored by U.S. DOE Environment Health & Safety. DOE Contract AC01-87EH79003. Order Number DE91001075. Source: NTIS, PC A19/MF A01 - OSTI; GPO Dep.

This report presents the preliminary findings from the first phase of the Environmental Survey of the US Department of Energy (DOE) Oak Ridge National Laboratory (ORNL), X-10 site, conducted August 17 through September 4, 1987. The Survey is being conducted by an interdisciplinary team of environmental specialists, led and managed by the Office of Environment, Safety and Health's Office of Environmental Audit. Individual team specialists are outside experts supplied by a private contractor. The objective of the Survey is to identify environmental problems and areas of environmental risk associated with ORNL. The Survey covers all environmental media and all areas of environmental regulation. It is being performed in accordance with the DOE Environmental Survey Manual. The on-site phase of the Survey involves the review of existing site environmental data, observations of the operations carried on at ORNL, and interviews with site personnel. The Survey team developed a Sampling and Analysis Plan to assist in further assessing certain of the environmental problems identified during its on-site activities. The Sampling and Analysis Plan will be executed by a DOE National Laboratory or a support contractor. When completed, the results will be incorporated into the Environmental Survey Interim Report for ORNL. The Interim Report will reflect the final determinations of the ORNL Survey. 120 refs., 68 figs., 71 tabs.

53627 (DOE/EH/OEV–33P) **Environmental Survey preliminary report, Department of Energy (DOE) activities at Santa Susana Field Laboratories, Ventura County, California.** USDOE Assistant Secretary for Environment, Safety, and Health, Washington, DC (USA). Office of Environmental Audit. Feb 1989. 220p. Sponsored by U.S. DOE Environment Health & Safety. DOE Contract AC01-87EH79003. Order Number DE91001090. Source: NTIS, PC A10/MF A01 - OSTI; GPO Dep.

This report presents the preliminary findings from the first phase of the Environmental Survey of the United States Department of Energy (DOE) activities at the Santa Susana Field Laboratories Site (DOE/SSFL), conducted May 16 through 26, 1988. The Survey is being conducted by an interdisciplinary team of environmental specialists, led and managed by the Office of Environment, Safety and Health's Office of Environmental Audit. Individual participants for the Survey team are being supplied by an private contractor. The objective of the survey is to identify environmental problems and areas of environmental risk associated with DOE activities at SSFL. The Survey covers all environmental media and all areas of environmental regulation. It is being performed in accordance with the DOE Environmental Survey Manual. This phase of the Survey involves the review of existing site environmental data, observations of the operations performed at SSFL, and interviews with site personnel. 90 refs., 17 figs., 28 tabs.

53628 (DOE/EH/OEV–34P) **Environmental Survey preliminary report, Strategic Petroleum Reserve, Texas and Louisiana Gulf Coast.** USDOE Assistant Secretary for Environment, Safety, and Health, Washington, DC (USA). Office of Environmental Audit. Jan 1989. 544p. Sponsored by U.S. DOE Environment Health & Safety. DOE Contract AC01-87EH79003. Order Number DE91001093. Source: NTIS, PC A23/MF A01 - OSTI; GPO Dep.

This report presents the preliminary environmental findings from the first phase of the Environmental Survey of the United States Department of Energy (DOE) Strategic Petroleum Reserve (SPR), located in Louisiana and Texas, and conducted in two segments from November 30 through December 11, 1987, and February 1 through 10, 1988. The Survey is being conducted by a multidisciplinary team of environmental specialists led and managed by the Office of Environment, Safety and Health's Office of Environmental Audit. Individual team specialists are outside experts being supplied by a private contractor. The objective of the Survey is to identify environmental problems and areas of environmental risk associated with SPR. The Survey covers all environmental media and all areas of environmental regulation. It is being performed in accordance with the DOE Environmental Survey Manual. This phase of the Survey involved the review of existing site environmental data, observations of the operations carried on at SPR, and interviews with site personnel. The Survey team has developed a Sampling and Analysis Plan to assist in further assessing specific environmental problems identified during its on-site activities. The Sampling and Analysis Plan will be executed by Idaho National Engineering Laboratory. When completed, the results will be incorporated into the SPR Survey findings for inclusion into the Environmental Survey Summary Report. The Summary Report will reflect the final determinations of the SPR Survey and the other DOE site-specific Surveys. 200 refs., 50 figs., 30 tabs.

53629 (DOE/EH/OEV–35P) **Environmental Survey preliminary report, Ames Laboratory, Ames, Iowa.** USDOE Assistant Secretary for Environment, Safety, and Health, Washington, DC (USA). Office of Environmental Audit. Mar 1989. 197p. Sponsored by U.S. DOE Environment Health & Safety. DOE Contract AC01-87EH79003. Order Number DE91001068. Source: NTIS, PC A09/MF A01 - OSTI; GPO Dep.

This report presents the preliminary findings of the first phase of the environmental Survey of the United States Department of Energy's (DOE) Ames Laboratory, conducted April 18 through 22, 1988. The Survey is being conducted by an interdisciplinary team of environmental specialists, led and managed by the Office of Environment, Safety and Health's Office of Environmental Audit. Individual team members are being supplied by private contractors. The objective of the Survey is to identify environmental problems and areas of environmental risk associated with the Ames Laboratory. The Survey covers all environmental media and all areas of environmental regulation. It is being performed in accordance with the DOE Environmental Survey Manual. This phase of the Survey involves the review of existing site environmental data, observations of the operations carried on at the Ames Laboratory, and interviews with site personnel. The Survey team developed a Sampling and Analysis (S&A) Plan to assist in further assessing certain of the environmental problems identified during its on-site activities. The S&A plan is being developed by the Idaho National Engineering Laboratory. When S&A is completed, the results will be incorporated into the Ames Laboratory Environmental Survey findings for inclusion in the Environmental Survey Summary Report. 60 refs., 13 figs., 20 tabs.

53630 (DOE/EH/OEV–38P) **Environmental Survey preliminary report, Stanford Linear Accelerator Center, Stanford, California.** USDOE Assistant Secretary for Environment, Safety, and Health, Washington, DC (USA). Office of Environmental Audit. Jul 1988. 277p. Sponsored by U.S. DOE Environment Health & Safety. DOE Contract AC01-87EH79003. Order Number DE91001061. Source: NTIS, PC A13/MF A01; OSTI; INIS; GPO Dep.

This report presents the preliminary findings from the first phase of the Survey of the US Department of Energy (DOE) Stanford Linear Accelerator Center (SLAC) at Stanford, California, conducted February 29 through March 4, 1988. The Survey is being conducted by an interdisciplinary team of environmental specialists, led and managed by the Office of Environment, Safety and Health's Office of Environmental Audit. Individual team components are being supplied by a private contractor. The objective of the Survey is to identify environmental problems and areas of environmental risk associated with the SLAC. The Survey covers all environmental media and all areas of environmental regulation and is being performed in accordance with the DOE Environmental Survey Manual. This phase of the Survey involves the review of existing site environmental data, observations of the operations at the SLAC, and interviews with site personnel. The Survey team is developing a Sampling and Analysis Plan to assist in further assessing certain of the environmental problems identified during its on-site activities. The Sampling and Analysis Plan will be executed by a DOE National Laboratory or a support contractor. When completed, the results will be incorporated into the Environmental Survey Interim Report for the SLAC facility. The Interim Report will reflect the final determinations of the SLAC Survey. 95 refs., 25 figs., 25 tabs.

53631 (DOE/EH/OEV–40P) **Environmental Survey preliminary report, National Institute for Petroleum and Energy Research, Bartlesville, Oklahoma.** USDOE Assistant Secretary for Environment, Safety, and Health, Washington, DC (USA). Office of Environmental Audit. Jan 1989. 150p. Sponsored by U.S. DOE Environment Health & Safety. DOE Contract AC01-87EH79003. Order Number DE91001099. Source: NTIS, PC A07/MF A01 - OSTI; GPO Dep.

This report presents the preliminary findings of the first phase of the Environmental Survey of the US Department of Energy's (DOE) National Institute for Petroleum and Energy Research (NIPER), conducted February 29 through March 4, 1988. The Survey is being conducted by an interdisciplinary team of environmental specialists, led and managed by the Office of Environment, Safety and Health's Office of Environmental Audit. Team members are being provided by private contractors. The objective of the Survey is to identify environmental problems and areas of environmental risk associated with NIPER. The Survey covers all environmental media and all areas of environmental regulation. It is being performed in accordance with the DOE Environmental Survey Manual. The on-site phase of the Survey involves the review of existing site environmental data, observations of the operations carried on at NIPER and interviews with site personnel. 35 refs., 8 figs., 15 tabs.

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Refer also to citation(s) 52661, 52671, 52888, 52958, 52960, 53061, 53084, 53088, 53114, 53602, 53705, 53757, 53769, 53775, 53776, 53837, 53840, 53845, 53846, 53859, 54181, 54182

53632 (AD-A–223866/5/XAB) **Use of Ni63 overvoltage gap switches in the flight-termination systems on boosters launched from US Army Kwajalein Atoll (USAKA).** Gallien, R. Army Strategic Defense Command, Huntsville, AL (USA). May 1990. 84p. Source: NTIS, PC A05/MF A01.

Original contains color plates: All DITC and NTIS reproductions will be in black and white.

This Environmental Assessment documents the results of an analysis of the potential for and the magnitude of impacts resulting from using Overvoltage Gap Switches containing Ni63 radioisotopes in the Flight Termination System of the Ground-Based Interceptor Boosters launched from the U.S. Army kwajalein Atoll.

53633 (AD-A–223869/9/XAB) **Source-emission test of Gas Turbine Engine Test Facility. Final report.** Vaughn, R.W.; Scott, P.T. Air Force Occupational and Environmental Health Lab., Brooks AFB, TX (USA). Apr 1990. 44p. (AFOEHL–90-064EQ00094DEF). Source: NTIS, PC A03/MF A01.

Source emission testing was conducted on the F-15 JFS and GT CP 85-180 gas turbine engines for particulates, carbon monoxide, total hydrocarbons, sulfur dioxide and nitrogen oxide. The present Gas Turbine Engine Test Facility is grandfathered per Texas Air Control Board and Federal (40CFR60) Regulations. The data in this report will be used to initiate a permit application for a new Gas Turbine Engine Test Facility.

53634 (BNL–44375) **Overview of the United States Department of Energy's ARM [Atmospheric Radiation Measurement] Program.** Stokes, G.M. (Pacific Northwest Lab., Richland, WA (USA)); Tichler, J.L. Brookhaven National Lab., Upton, NY (USA). Jun 1990. 8p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. (CONF-900762–1: 12. international CODATA conference: data for discovery, Columbus, OH (USA), 17-19 Jul 1990). Order Number DE91001126. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The Department of Energy (DOE) is initiating a major atmospheric research effort, the Atmospheric Radiation Measurement Program (ARM). The program is a key component of DOE's research strategy to address global climate change and is a direct continuation of DOE's decade-long effort to improve the ability of General Circulation Models (GCMs) to provide reliable simulations of regional, and long-term climate change in response to increasing greenhouse gases. The effort is multi-disciplinary and multi-agency, involving universities, private research organizations and more than a dozen government laboratories. The objective of the ARM Research is to provide an experimental testbed for the study of important atmospheric effects, particularly cloud and radiative processes, and to test parameterizations of these processes for use in atmospheric models. This effort will support the continued and rapid improvement of GCM predictive capability. 2 refs.

53635 (BNL–45216) **A preliminary ocean ARM [Atmospheric Radiation Measurements] guide for climatic evaluations.** Brown, R.M. Brookhaven National Lab., Upton, NY (USA). Jul 1990. 63p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. Order Number DE91001120. Source: NTIS, PC A04/MF A01 - OSTI; GPO Dep.

This guide was made to assist in the task of selecting sites for the Atmospheric Radiation Measurements (ARM) study. It is a preliminary attempt to provide mean annual and seasonal meteorological data that might be useful in initial climatic evaluations. It is not a finished product and will be added to in time to give other important information on parameters such as standard deviations, % of means and times, and other variances. In order to cover the spectrum of climatic factors to be considered, this generalized climatic guide was established from various publications to provide a diversified set of basic meteorological data that exists. To comply with other site selection restrictions, namely, synergism with other programs and scientific and logistical viability, this guide covers only the United States, except for the material at the end on Koppens World Climate Classification. It is anticipated that a similar guide will be made to cover the world's climate at a later date. 3 refs., 63 figs.

53636 (CEA-R–5410) **Modelling air pollution transfers in the Fos-sur-Mer area.** Dibi, N.M. CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Protection Sanitaire. Sep 1987. 129p. (In French). Order Number DE88751888. Source: NTIS (US Sales Only), PC A07/MF A01 - OSTI.

A "puff" gaussian model with determined standard deviations based on transfer times of two classes of vertical stability of the atmosphere was developed in order to evaluate the atmospheric dispersion of industrial discharges in the Fos-sur-Mer area. This research was carried out within the framework of a large study for the processing of the data obtained during the measurement campaign organized by the European Communities. The model in its analytic form allows consideration of the main phenomena which modify the puff content during the transfer: reflectance, wet and dry deposition, physical-chemical transformation of the pollutant SO_2. The model includes the site meteorological parameters measured in three dimensions (wind speed and direction at ground level and in altitude) and the characteristics of the different stacks. It can also calculate pollutions resulting from a short emission or from continuous emissions. Examples are presented.

53637 (CONF-900355–1) **The response of atmospheric CO_2 to changes in land use.** King, A.W.; Emanuel, W.R.; Post, W.M. Oak Ridge National Lab., TN (USA). [1990]. 52p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From Chapman conference on global biomass burning: atmospheric, climatic, and biospheric implications; Williamsburg, VA (USA); 19-23 Mar 1990. Order Number DE91001212. Source: NTIS, PC A04/MF A01 - OSTI; GPO Dep.

The burning of biomass that often accompanies deforestation and other changes in land use is believed to be a major contributor to documented increases in the concentration of atmospheric CO_2. Using three models of carbon turnover in the atmosphere and ocean, we simulate changes in atmospheric CO_2 that result from the addition of CO_2 from industrial sources and terrestrial ecosystems disturbed by changes in land use. We simulate atmospheric response to different histories of terrestrial biospheric CO_2 release, and we compare these simulations with the history of atmospheric CO_2 obtained from ice core measurements and atmospheric monitoring stations. 63 refs., 12 figs., 1 tab.

53638 (CRIE-T–89028) **Structures and mechanisms of land-and-sea breezes around the eastern Setouchi area.** Senshu, T. Central Research Inst. of Electric Power Industry, Komae, Tokyo (Japan). Energy and Environment Lab. Mar 1990. 119p. (In Japanese). Order Number DE91715327. Source: NTIS (US Sales Only), PC A06/MF A01.

Land-and-sea breezes are a factor affecting the flue gas diffusion. The analysis on days of land-and sea breezes requires the compaison with the days of non-land-and-sea breezes and also requires distinction of yearly, daily and hourly metrological patterns. Air flow patterns were classified by using hourly data at 70 observation stations in the eastern Setouchi area in 1980. General flow prevailing wind is observed at the winter pressure pattern in which high pressure area lies to the west and the low pressure area to the east and the uniform wind direction is gale in general. Local flow prevailing wind tends to generate weak pressure gradient and continue fine days, generating southeast wind from Halimanada to inland and southwest wind from Mizushimanada to inland. Both winds are land-and-sea breezes based on any temperature difference. When observing the vertical structure of land-and-sea breezes, sea breeze arrives at several hundred meters over the ground level during daytime and land breeze arrives at one or two hundred meters. Further, when observing the vertical structure of land-and-sea breezes, converging zone exists in lower area and diverging zone generated by counterflow compensating the former exists in upper area. Since the atmosphere is not a closed system practically, the circulating system shown in the model can hardly be established as it is. 15 refs., 55 figs., 14 tans.

53639 (DLR-FB–90-25) **Simulation of the formation and transport of ozone in the atmospheric boundary layer.** Graf, J. (Deutsche Forschungsanstalt fuer Luft- und Raumfahrt e.V. (DLR), Wessling (Germany, F.R.). Inst. fuer Physik der Atmosphaere). Deutsche Forschungsanstalt fuer Luft- und Raumfahrt e.V. (DLR), Koeln (Germany, F.R.); Muenchen Univ. (Germany, F.R.). Fakultaet fuer Physik. 1990. 103p. (In German). Order Number DE91717018. Source: NTIS (US Sales Only), PC A06/MF A01.

A numerical model is introduced to simulate chemical processes in the lower atmosphere with special aspect to the ozone formation. For this purpose the treatment of gasphase chemistry is sufficient. The model is used to simulate the ozone formation in an urban area caused by motorcar emissions. The results illustrate the strong effect of hydrocarbon emissions on the ozone production. The combined effects of horizontal transport, vertical diffusion and chemical reactions are investigated in the regional scale. High ozone levels in nonindustrial areas are mainly due to the transport of ozone precursors. A real episode simulation shows the importance of the initial concentrations on the resulting ozone distribution. (orig.) With 68 figs., 3 tabs., 69 refs.

53640 (DOE/ER/60983–1) **CO_2 measurements along WOCE P-16 and 19 sections in the South Pacific Ocean: A joint LDGO/WHOI program: Progress report.** Takahashi, Taro. Columbia Univ., Palisades, NY (USA). Lamont-Doherty Geological Observatory. 30 Jul 1990. 8p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-90ER60983. Order Number DE91000878. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

This report covers the progress made since June 1, 1990, the beginning of this grant. The objective of the six-month period covered by this grant is to prepare for the field operations in the South Pacific Ocean. The coulometer and gas chromatograph systems,

which will be used for the measurements of the total CO_2 concentration and pCO_2 aboard research ships, are being calibrated presently. Various spare parts needed for the expedition are being ordered, and the Pure-Air generators and hydrogen generators are being serviced. Our preparation is on schedule. We have participated in two meetings where the problems associated with instrumentation and calibration were actively discussed among the participants of the DOE CO_2 program.

53641 (DOE/PE–0096P) **The economics of long-term global climate change: A preliminary assessment.** USDOE Office of Policy, Planning and Analysis, Washington, DC (USA). Sep 1990. 49p. Sponsored by U.S. DOE Office of Policy, Planning and Analysis. Order Number DE91000467. Source: NTIS, PC A04/MF A01 - OSTI; GPO Dep.

Report of an Interagency Task Force.

This report is intended to provide an overview of economic issues and research relevant to possible, long-term global climate change. It is primarily a critical survey, not a statement of Administration or Department policy. This report should serve to indicate that economic analysis of global change is in its infancy few assertions about costs or benefits can be made with confidence. The state of the literature precludes any attempt to produce anything like a comprehensive benefit-cost analysis. Moreover, almost all the quantitative estimates regarding physical and economic effects in this report, as well as many of the qualitative assertions, are controversial. Section I provides background on greenhouse gas emissions and their likely climatic effects and on available policy instruments. Section II considers the costs of living with global change, assuming no substantial efforts to reduce greenhouse gas emissions. Section III considers costs of reducing these emissions, though the available literature does not contain estimates of the costs of policies that would, on the assumptions of current climate models, prevent climate change altogether. The individual sections are not entirely compartmentalized, but can be read independently if necessary.

53642 (HW–79303) **A field method using uranine to measure penetration of high-efficiency filters.** Wisehart, D.E. General Electric Co., Richland, WA (USA). Hanford Atomic Products Operation. 18 Oct 1963. 9p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC06-76RL01830. Order Number DE91001400. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

A method has been developed to field test high-efficiency air cleaning filters to measure their efficiency in removing aerosols from contaminated air streams. In certain instances, the efficiency of air cleaning filters may be measured prior to installation. For example, high-efficiency filters of the "absolute" type are measured for their efficiency of removal of a 0.3 micron dioctylphthalate aerosol from an air stream prior to use at AEC installations. However, defects may occur during or following the installation of the filters in process or building air streams. Therefore, methods of field testing the filters following their installation are desirable. The efficiency of an installed filter or filters for removal of either a process or artificially produced aerosol can usually be measured. Process aerosols are in most cases difficult to measure quantitatively, however, and usually have varying particle size characteristics. Therefore, an artificial aerosol, uranine, was selected for measurement purposes. The uranine aerosol may be generated by equipment that is light in weight, low in cost and easily transported. Its particle size distribution and generation rate is reproducible in successive tests and may be varied if desired. Uranine may be determined quantitatively in submicrogram quantities by fluorescent spectroscopy. The determinations require a minimum of time and utilize equipment available to most laboratories. 1 ref., 4 figs.

53643 (IABG-B-TD–9003/02) **Model calculations for the estimation of dry deposition of atmospheric trace substances. Final report.** Kramm, G. Industrieanlagen-Betriebsgesellschaft mbh (IABG), Ottobrunn (Germany, F.R.). Hauptabteilung Datenverarbeitung und Informatik. 31 Jul 1986. 50p. (In German). Contract IABG 946 5518 01 (PNC). Source: Available from Industrieanlagen-Betriebsgesellschaft mbH (IABG), Ottobrunn (Germany, F.R.). Hauptabteilung Datenverarbeitung und Informatik.

A numerical model will be demonstrated with which the deposition rate and deposition velocity of slowly reacting atmospheric trace elements can be determined using a detailed calculation of the turbulent flow. The process is so conceived that it only needs the profile data of the concentration and the meteorolgical field determinants in the turbulent phase of the air layer near to the ground. To determine the terminal conditions in the turbulent phase the so called K-theory is used, in the molecular turbulent lower layer a 'sublayer' STANTON number and the REYNOLDS analogy between the concentration distribution, the temperature profile and the wind velocity profile. Numerical examples, taken from the measurements from various field experiments are discussed. Using the NO-NO_2-O_3 system as an example it will be shown how the process can also be used for reactive trace elements. (orig.) With 2 tabs., 11 figs., 37 refs.

53644 (IPEN-PUB–296) **Numerical modelling of the atmospheric mixing-layer diurnal evolution.** Molnary, L. de. Instituto de Pesquisas Energeticas e Nucleares (IPEN), Sao Paulo, SP (Brazil). Mar 1990. 40p. (In Portuguese). Order Number DE91605733. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

This paper introduce a numeric procedure to determine the temporal evolution of the height, potential temperature and mixing ratio in the atmospheric mixing layer. The time and spatial derivatives were evaluated via forward in time scheme to predict the local evolution of the mixing-layer parameters, and a forward in time, upstream in space scheme to predict the evolution of the mixing-layer over a flat region with a one-dimensional advection component. The surface turbulent fluxes of sensible and latent heat were expressed using a simple sine wave that is function of the hour day and kind of the surface (water or country). (author).

53645 (ISI-B–30-88) **Hydrogen energy technology. A literature and data analysis.** Morovic, T.; Pilhar, R.; Witt, B. Fraunhofer-Institut fuer Systemtechnik und Innovationsforschung (ISI), Karlsruhe (Germany, F.R.); Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.). 1988. 76p. (In German). Contract BMFT 0326573A. Source: Available from Fraunhofer-Institut fuer Systemtechnik und Innovationsforschung (ISI), Karlsruhe (Germany, F.R.).

A comprehensive assessment of different energy systems from the economic point of view has to be based on data showing all relevant costs incurred and benefits drawn by the society from the use of such energy systems, i.e. internal costs and benefits visible to the energy consumer as prices paid for power supplied, as well as external costs and benefits. External costs or benefits of energy systems cover among other items employment or wage standard effects, energy-induced environmental impacts, public expenditure for pollution abatement and mitigation of risks and effects of accidents, and the user costs connected with the exploitation of reserves, which are not rated high enough to really reflect and demonstrate the factor of depletion of non-renewable energy sources, as e.g. fossil reserves. Damage to the natural and social environment induced by anthropogenous air pollutants up to about 90% counts among external costs of energy conversion and utilisation. Such damage is considered to be the main factor of external energy costs, while the external benefits of energy systems currently are rated to be relatively unsignificant. This means that an internalisation of external costs would drive up current prices of non-renewable energy sources, which in turn would boost up the economics of renewable energy sources, and the hydrogen produced with their energy. Other advantages attributed to most of the renewable energy sources and to hydrogen energy systems are better environmental compatibility, and no user costs. (orig.).

53646 (MIC–90-04553/XAB) **Pre-development distribution patterns of cesium-137, uranium and companion elements in lichen heath near Baker Lake, N.W.T.: Summary of findings, March 1987. Environmental Studies No. 63.** Kershaw, K.A. Department of Indian Affairs and Northern Development, Ottawa, ON (Canada). Northern Affairs Program. ©1989. 48p. (SSC-R–71-19/63-1989E). Source: NTIS, PC EE07/MF E01.

The intent of the 1982-84 Arctic Land Use Research (ALUR) program was to establish the pre-development background levels of selected elements within the thalli of a number of Arctic lichen species. Lichens are successfully used in various parts of the world as environmental monitors around smelters, manufacturing

plants, power generating stations, urban centres and uranium mines. In this study, specimens were collected from permanent plots established on transects emanating from the uranium deposit at Lone Gull Lake near Baker Lake, N.W.T. Field work was conducted in July and August of 1982 and analysis of the plant tissues was done by X-ray fluorescence spectrometry for Ti, Fe, Cu, Ni, Pb, S, Ca and K. Cesium was determined using gamma-ray spectrometry and alpha-particle spectrometry was also done.

53647 (MIC–90-04595/XAB) **CFCs and halons in Nova Scotia: A use analysis study with recommendations for control options.** Gordon, J.R. Nova Scotia Ministry of the Environment, Halifax, NS (Canada). ©1989. 41p. Source: NTIS, PC EE07/MF E01.

The Nova Scotia Ozone Layer Protection Act is one of a number of statutory responses by provincial and municipal governments in Canada initiated and designed to help implement Canada's obligations to the 1987 Montreal Protocol on Substances that Deplete the Ozone Layer. Nova Scotia passed enabling legislation to undertake a broad range of measures to protect the global atmospheric commons from abuses by Nova Scotians. However, the Act depends upon the development and implementation of regulations to achieve its full potential. This study was commissioned to develop the necessary background information needed for the preparation of regulations for the control of the chlorofluorocarbon (CFC) and bromofluorocarbon (Halon) groups of substances, and to suggest other appropriate mechanisms or control strategies. The report gives a detailed summary of the result of a survey of industrial and commercial users of CFCs and Halons in Nova Scotia, assesses their potential impact on the industrial sector of restricting their use, and makes recommendations on available control options.

53648 (MIC–90-04604/XAB) **Canadian emissions inventory of common air contaminants, 1985. Report No. EPS 5/AP/3. (Annual).** Kostelz, A.; Deslauriers, M. Environment Canada, Ottawa, ON (Canada). Environmental Protection Service. ©1990. 140p. (SSC-EN –49-5/5-3E). Source: NTIS, PC EE12/MF E01.

Text in English and French (Bilingual). French ed. 90-04603/2.

Environment Canada has maintained a national emissions inventory since the early 1970s. Since that time, the inventory process has been continually modified to minimize the errors in the estimation process and to complement other environmental studies. This report presents the results of the 1985 national emissions inventory, a description of the general methodologies employed, an examination of the computerized data handling system, and additional information assembled for modelling activities.

53649 (MIC–90-04606/XAB) **National inventory of sources and emissions of benzene, 1985. Report No. EPS 5/AP/1.** Jaques, A.P. Environment Canada, Ottawa, ON (Canada). Environmental Protection Service. ©1990. 75p. (SSC-EN –49-5/5-1E). Source: NTIS, PC EE07/MF E01.

Text in English and French (Bilingual). French ed. 90-04605/1.

Estimates of the quantities of benzene released to the environment as emissions in 1985, classified by source, sector, and province. These estimates are based on sampling data, process emission factors, and production figures. A brief summary of the sources and uses of benzene is included, as well as a summary of its health effects and an analysis and description of trends in emissions. A description of the methodology and its accuracy are included.

53650 (MIC–90-04770/XAB) **Regulation of industrial toxic and hazardous emissions in Ontario as compared with selected jurisdictions. Volume 1: Summary and conclusions.** Hickling (James F.) Management Consultants Ltd., Ottawa, ON (Canada). ©1990. 118p. Source: NTIS, PC EE12/MF E01.

In pursuit of environmentally sound economic development in Ontario, the government recently developed a number of policy initiatives in environmental protection. Two major initiatives, resulting in the establishment of more stringent standards on effluents and emissions released into the environment, are the Municipal Industrial Strategy for Abatement (MISA) which aims to achieve the virtual elimination of toxic contaminants in municipal and industrial discharges into waterways, and proposed revisions to Regulation 308 of the Environmental Protection Act to impose direct emission limits on all air pollution sources of any appreciable size. This study determined if Ontario's proposed regulations constitute a competitive disadvantage for industries in the province. The study compared Quebec and Alberta to Ontario, as well as to a set of 12 U.S. states and, to a lesser degree, 6 OECD countries. Nine industry sectors were targeted as those most likely to bear the heaviest burden under the regulatory initiatives.

53651 (NEDO-P–8914) **Survey on new energy technology related to the global environmental issues.** New Energy Development Organization, Tokyo (Japan). Mar 1990. 234p. (In Japanese). Order Number DE91715394. Source: NTIS (US Sales Only), PC A11/MF A01.

In relation to the global warming issues by carbon dioxide, new technology was explained in an example. It was assumed to fix and recycle 5% (500ton/day) or 20% (2000ton/day) of carbon dioxide, discharged by the object which was fixed generation sources (approx. 60% of the total discharge volume) of huge volume of carbon dioxide, including, among others, oil-fired thermal power plants, steel mills and cement factories. If 100 is realized as a separation rate (carbon dioxide/nitrogen), it is, as a separation and recovery method (carbon dioxide being concentrated at 80% or 95%), also economically comparable to the conventional pressure swing absorption method and absorption method. Recovered carbon dioxide was studied for methanol synthesis by catalytic hydrogenation method. As an object, hydrogen necessary for the synthesis took solid polymer electrolyte water electrolysis, possible in development and the highest in efficiency. it is at the almost same level in cost, excluding that for raw material gas, as conventional methanol synthesis from carbon monoxide and hydrogen, and has a possibility to be sufficiently realized if high performance catalyst is developed. From study of total system, it became, though having a high possibility to be realized, more expensive, with hydrogen production accounting for 70% to 80% of the total cost, than the conventional method. 112 refs., 58 figs., 83 tabs.

53652 (NIR–2/88) **Aerosol fertilization of damaged vegetation. Final report. Pt. 2. Aerosol-physical investigations.** Taeschner, M. Niedersaechsisches Inst. fuer Radiooekologie, Hannover (Germany, F.R.). Aug 1988. 51p. (In German). Order Number DE91717159. Source: NTIS (US Sales Only), PC A04/MF A01.

This report belongs to the three-part research project 'Aerosol fertilization of damaged vegetation' that has been carried through since 1985 by a working group composed of staff of Messrs. NICO Pyrotechnik, the Forstbotanisches Institut of the University of Goettingen (FBI), and the Niedersaechsisches Institut fuer Radiooekologie NIR. The NIR report deals with part II: 'Aerosol-physical investigations'. It looks into the propagation processes of nutrient aerosol in the test stands and presents the analyses of the nutritive element content of the spruce needles sampled. (orig./MG).

53653 (ORNL/CDIAC–36) **TRENDS '90: A compendium of data on global change.** Sepanski, R.J.; Stoss, F.W. (eds.); Boden, T.A.; Kanciruk, P.; Farrell, M.P. Oak Ridge National Lab., TN (USA). Carbon Dioxide Information Analysis Center. Aug 1990. 527p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE91000587. Source: NTIS, PC A23/MF A01 - OSTI; GPO Dep.

This document is a source of frequently used global change data. This first issue includes estimates for global and national CO_2 emissions from the burning of fossil fuels and from the production of cement, historical and modern records of atmospheric CO_2 and methane concentrations, and several long-term temperature records. Included are tabular and graphical presentations of the data, discussions of trends in the data, and references to publications that provide further information. Data are presented in a two-page format, each dealing with a different data set. All data are available in digital form from the Carbon Dioxide Information Analysis Center.

53654 (ORNL/ER–16) **Data base management activities for the Remedial Action Program at Oak Ridge National Laboratories (ORNL): Calendar year 1989.** Hook, L.A.; Voorhees, L.D.; Gentry, M.J.; Faulkner, M.A.; Shaakir-Ali, J.A.; Newman, K.A.; McCord, R.A.; Goins, L.F.; Owen, P.T. Oak Ridge National Lab., TN

(USA). Jul 1990. 97p. Sponsored by U.S. DOE Management & Administration. DOE Contract AC05-84OR21400. Order Number DE91001025. Source: NTIS, PC A06/MF A01 - OSTI; GPO Dep.

Environmental Sciences Division Publication No. 3506.

The Oak Ridge National Laboratory (ORNL) Remedial Action Program (RAP) was established in 1985 in response to state and federal regulations requiring comprehensive control over facility discharges and cleanup of contaminated sites. A computerized Data and Information Management System (DIMS) was developed for RAP to (1) provide a centralized repository for data pertinent to RAP and (2) provide support for the investigations and assessments leading to the long-term remediation of contaminated facilities and sites. The current status of DIMS and its role in supporting RAP during 1989 are described. The DIMS consists of three components: (1) the Numeric Data Base, (2) the Bibliographic Data Base, and (3) the Records Control Data Base. This report addresses all three data bases, but focuses on the contents of the Numeric Data Base. Significant progress was made last year with the geographic information system (GIS) and ARC/INFO, which can be interfaced with SAS/GRAPH to provide combined mapping and statistical graphic products. Several thematic layers of GIS data for the Oak Ridge Reservation are now available. 18 refs., 8 figs., 19 tabs.

53655 (PB–90-215419/XAB) **National Radon Contractor Proficiency (RCP) Program. Proficiency report.** ICF, Inc., Fairfax, VA (USA). Jul 1990. 181p. Contract EPA-68-D90170. Source: NTIS, PC A09/MF A01.

See also PB–90-187949.

The report will assist State, EPA Regions, and local government officials in providing advice to the public on the selection of proficient radon mitigation contractors. The Proficiency Report is a listing of 895 contractors who have met the requirements of EPA's National Radon Contractor Proficiency (RCP) Program as of May 19, 1990. Each contractor is listed by name, RCP identification number, company name, address, phone number, and geographic service area.

53656 (PB–90-257791/XAB) **Radon mitigation studies: Nashville demonstration. Final report, September 1987-March 1990.** Pyle, B.E.; Williamson, A.D. Southern Research Inst., Birmingham, AL (USA). Jul 1990. 283p. (SRI-ENV–90-275-6411-10). Source: NTIS, PC A13/MF A02.

See also PB–88-211925.

The report gives results of an EPA radon mitigation demonstration project involving 14 houses in the Nashville, TN, area with indoor radon levels of 5.6-47.6 pCi/L, using a variety of techniques, designed to be the most cost effective methods possible to implement, and yet adequately reduce radon levels to < 4 pCi/L. For crawl space houses, the techniques included sealing openings between living areas and crawl spaces and then passively venting the crawl spaces, depressurizing the crawl spaces, depressurizing under polyethylene sheeting in the crawl spaces, and depressurizing the crawl space soil itself. For basement and basement/crawl space combination houses, the techniques included sub-slab pressurization and depressurization, block wall depressurization, and combinations of these techniques with some of those listed above for exposed soil areas. Post-mitigation worst-case radon levels in these houses were generally from < 1 to about 5 pCi/L, with one house near 15 pCi/L. These houses are currently being followed with alpha-track detectors to assess the long term exposure levels.

53657 (PB–90-258872/XAB) **Evaluation test of the Kaiser permanente hospital waste incinerator in San Diego.** McCormack, J.; Ouchida, P.; Lew, G. California State Air Resources Board, Sacramento, CA (USA). Monitoring and Lab. Div. Mar 1990. 176p. (ARB/ML–90-030). Source: NTIS, PC A09/MF A01.

See also PB–89-103949. Portions of this document are not fully legible.

A series of emission tests were conducted on a hospital waste incinerator. The hospital waste incinerator burns up to 600 pounds per hour of infectious hospital waste. The objectives of the incinerator emission test were to characterize criteria and selected non-criteria air pollutants released to the atmosphere. The criteria air pollutants were carbon monoxide, total hydrocarbons, sulfur dioxide, oxides of nitrogen, and total particulate matter. In addition, CO_2, and O_2 were measured. Some of the selected non-criteria air pollutants included dioxins, furans, PCBs, semi-volatile organics, volatile organics, hydrogen chloride, hexavalent chromium, and mercury.

53658 (PB–90-259714/XAB) **BACT/LAER Clearinghouse: A compilation of control-technology determinations.** PEI Associates, Inc., Cincinnati, OH (USA). Jun 1990. 1630p. Source: NTIS, PC EE99/MF E99.

Set includes PB–90-259722 through PB–90-259755.

A separate abstract is included for each of the 4 volumes of this set.

53659 (PB–90-259722/XAB) **BACT/LAER Clearinghouse: A compilation of control-technology determinations. Volume 1. Report summary and appendices A-G. Final report.** Steigerwald, J. PEI Associates, Inc., Cincinnati, OH (USA). Jun 1990. 220p. Contract EPA-68-02-4394. Source: NTIS, PC A10/MF A02.

See also Volume 2, PB–90-259730 and PB–85-229664. Also available in set of 4 reports PC E99/MF E99, PB–90-259714.

The Clean Air Act as amended in 1977 prescribes several technology-based limitations affecting new or modified air pollution sources: (1) new source performance standards (NSPS); (2) best available control technology (BACT); and (3) lowest achievable emission rate (LAER). The basic purposes of the BACT/LAER Clearinghouse are to: (1) provide State and local air pollution control agencies with current information on case-by-case control technology determinations that are made nationwide and (2) promote communication, cooperation, and sharing of control technology information among the permitting agencies. The information presented in this compilation was abstracted from preconstruction permits and submitted voluntarily by the State and local air pollution control agencies. The Clearinghouse is intended as a reference for State and local agencies in making BACT/LAER decisions. Since the 1985 BLC document was published in June of that year, annual supplements containing only those determinations inserted or revised during the previous 12 months were published. A master edition containing all new/revised determinations completed during the past 5 years was planned to be published every 5 years. The report is the 5 year compilation containing all determinations inserted or updated since June 1985. The volume covers background information and improvements of the system as well as appendices A-G.

53660 (PB–90-259730/XAB) **BACT/LAER Clearinghouse: A compilation of control-technology determinations. Volume 2. Appendix H, source codes 1-3. Final report.** Steigerwald, J. PEI Associates, Inc., Cincinnati, OH (USA). Jun 1990. 384p. Contract EPA-68-02-4394. Source: NTIS, PC A17/MF A02.

See also Volume 1, PB–90-259722 and Volume 3, PB–90-259748 and PB–85-229672. Also available in set of 4 reports PC E99/MF E99, PB–90-259714.

The Clean Air Act as amended in 1977 prescribes several technology-based limitations affecting new or modified air pollution sources: (1) new source performance standards (NSPS); (2) best available control technology (BACT); and (3) lowest achievable emission rate (LAER). The basic purposes of the BACT/LAER Clearinghouse are to: (1) provide State and local air pollution control agencies with current information on case-by-case control technology determinations that are made nationwide and (2) promote communication, cooperation, and sharing of control technology information among the permitting agencies. The information presented in the compilation was abstracted from preconstruction permits and submitted voluntarily by the State and local air pollution control agencies. The Clearinghouse is intended as a reference for State and local agencies in making BACT/LAER decisions. Since the 1985 BLC document was published in June of that year, annual supplements containing only those determinations inserted or revised during the previous 12 months were published. A master edition containing all new/revised determinations completed during the past 5 years was planned to be published every 5 years. The report is the 5 year compilation containing all determinations inserted or updated since June 1985. The volume contains appendice H which discusses detailed source listings for new determinations Source codes 1-3.

53661 (PB–90-259748/XAB) **BACT/LAER Clearinghouse: A compilation of control-technology determinations. Volume 3. Appendix H, source codes 4 to 6. Final report.** Speigerwald, J. PEI Associates, Inc., Cincinnati, OH (USA). Jun 1990. 541p. Contract EPA-68-02-4394. Source: NTIS, PC A23/MF A03.

See also Volume 2, PB–90-259730 and Volume 4, PB–90-259755 and PB–85-229680. Also available in set of 4 reports PC E99/MF E99, PB–90-259714.

The Clean Air Act as amended in 1977 prescribes several technology-based limitations affecting new or modified air pollution sources: (1) new source performance standards (NSPS); (2) best available control technology (BACT); and (3) lowest achievable emission rate (LAER). The basic purposes of the BACT/LAER Clearinghouse are to: (1) provide State and local air pollution control agencies with current information on case-by-case control technology determinations that are made nationwide and (2) promote communication, cooperation, and sharing of control technology information among the permitting agencies. The information presented in this compilation was abstracted from preconstruction permits and submitted voluntarily by the State and local air pollution control agencies. The Clearinghouse is intended as a reference for State and local agencies in making BACT/LAER decisions. Since the 1985 BLC document was published in June of that year, annual supplements containing only those determinations inserted or revised during the previous 12 months were published. A master edition containing all new/revised determinations completed during the past 5 years was planned to be published every 5 years. The report is the 5 year compilation containing all determinations inserted or updated since June 1985. The volume is a continuation of appendice H which discusses detailed listings for new determinations Source codes 4-7.

53662 (PB–90-259755/XAB) **BACT/LAERR Clearinghouse: A compilation of control-technology determinations. Volume 4. Appendix H, source codes 7 to 12. Final report.** Steigerwald, J. PEI Associates, Inc., Cincinnati, OH (USA). Jun 1990. 485p. Contract EPA-68-02-4394. Source: NTIS, PC A21/MF A03.

See also Volume 3, PB–90-259748 and PB–85-229698. Also available in set of 4 reports PC E99/MF E99, PB–90-259714.

The Clean Air Act as amended in 1977 prescribes several technology-based limitations affecting new or modified air pollution sources: (1) new source performance standards (NSPS); (2) best available control technology (BACT); and (3) lowest achievable emission rate (LAER). The basic purposes of the BACT/LAER Clearinghouse are to: (1) provide State and local air pollution control agencies with current information on case-by-case control technology determinations that are made nationwide and (2) promote communication, cooperation, and sharing of control technology information among the permitting agencies. The information presented in this compilation was abstracted from preconstruction permits and submitted voluntarily by the State and local air pollution control agencies. The Clearinghouse is intended as a reference for State and local agencies in making BACT/LAER decisions. Since the 1985 BLC document was published in June of that year, annual supplements containing only those determinations inserted or revised during the previous 12 months were published. A master edition containing all new/revised determinations completed during the past 5 years was planned to be published every 5 years. The report is the 5 year compilation containing all determinations inserted or updated since June 1985. The volume is a continuation of appendice H which discusses detailed source listings for new determinations Source codes 8-12.

53663 (PB–90-259870/XAB) **Analysis of air-toxics emissions, exposures, cancer risks and controllability in five urban areas. Volume 2. Controllability analysis and results.** Wilson, J.; Coleman, B.; Laich, E.; Powell, R. Environmental Protection Agency, Research Triangle Park, NC (USA). Office of Air Quality Planning and Standards. Apr 1990. 107p. (EPA–450/2-89/012B). Source: NTIS, PC A06/MF A01.

See also PB–89-207161.

The report (Volume 2) is the second phase of a study to define the urban air toxics problem and to discern what combination of control measures can best be employed to mitigate the problem. Volume 1 of the study documented the base year analysis (nominally the year 1980), involving dispersion modeling of emissions data for 25 carcinogenic air toxics in five U.S. urban areas and a subsequent assessment of estimated aggregate cancer incidence. The Volume 2 report applies various control strategies and analyzes the resulting reduction in aggregate cancer incidence that would occur between 1980 and 1995. Control scenarios consisted of (1) efforts that were currently underway to reduce air toxics emissions at the time of the study, (2) efforts that were expected to occur by 1995, mainly national standards that were under development, and (3) a series of selected more rigorous controls.

53664 (PB–90-259888/XAB) **Idaho radionuclide study (radionuclide exposure study, Pocatello and Soda Springs, Idaho).** Environmental Protection Agency, Las Vegas, NV (USA). Office of Radiation Programs. Apr 1990. 57p. (EPA–520/6-90/008). Source: NTIS, PC A04/MF A01.

See also DE88002573.

The report gives the results of a radionuclide exposure study conducted by EPA in southeastern Idaho to estimate the radiation dose resulting from the elemental phosphorus industry. The dispersion of radionuclides through the environs of Pocatello and Soda Springs, Idaho were investigated together with the relative importance of their sources and pathways affecting the populations of both towns and the magnitude of the attendant risks. Gamma ray exposures to the populations of Soda Springs and Pocatello, with the attendant risks, and the corresponding values for average and maximally exposed individuals in both communities are listed.

53665 (PB–90-259946/XAB) **ARB evaluation test conducted on a hospital-waste incinerator at Los Angeles Co., USC Medical Center, Los Angeles, California. Technical report.** McCormack, J.; Ouchida, P.; Lew, G. California State Air Resources Board, Sacramento, CA (USA). Monitoring and Lab. Div. Jan 1990. 127p. (ARB/ML–90-029). Source: NTIS, PC A07/MF A01.

A series of emission tests were conducted on a small hospital waste incinerator. The small hospital waste incinerator burns less than 100 pounds per hour of infectious hospital waste and burns a total of no more than 300 pounds per day. Hospital waste incinerators previously tested by the ARB were rated at 600 to 1000 pounds per hour. The small incinerator is manually charged and cleaned. The objectives of the incinerator emission test were to characterize criteria and select non-criteria air pollutants released to the atmosphere. The criteria air pollutants were carbon monoxide, total hydrocarbons, sulfur dioxide, oxides of nitrogen. In addition, CO2, PM, and O2 were measured. Some of the select non-criteria air pollutants included dioxins, furans, PCBs, semivolatile organics, volatile organics, hydrogen chloride, hexavalent chromium, and mercury.

53666 (PB–90-260449/XAB) **EPA mobile incineration-system modifications, testing and operations, February 1986 to June 1989.** Stumbar, J.P.; Gupta, G.D.; Sawyer, R.; Sherman, A.; Hastings, K.E. Foster Wheeler Enviresponse, Inc., Edison, NJ (USA). Aug 1990. 283p. Contract EPA-68-03-3255. Source: NTIS, PC A13/MF A02.

See also PB–88-170428.

The report covers the field demonstration activities of the U.S. Environmental Protection Agency's Mobile Incineration System (MIS) from February 1986 to June 1989 at the Denney Farm Site, Missouri. The activities discussed in the current report include: modifications made to the MIS to double its capacity and to improve its reliability; the 1987 trial burn for Resource Conservation and Recovery Act (RCRA) and Toxic Substances Contract Act (TSCA) wastes; tests to show the feasibility of processing brominated sludge and cancelled pesticides, including testing for metals emissions; delisting tests for the brominated sludge; site and incinerator closure activities; and the accomplishments, problems encountered, and solutions implemented during the operation of the MIS. In addition, a system availability analysis is presented. The information contained in the report is of benefit to those in the public sector who are considering or are currently applying incineration technology as a remedial alternative.

53667 (PB–90-260514/XAB) **Responses to the Environmental Health and Safety (EH and S) questionnaire on liquid redox**

sulfur-recovery processes. Final report. Rueter, C.O. Radian Corp., Austin, TX (USA). Jun 1990. 160p. Contract GRI-5086-253-1275. (DCN-90-218-043-66). Source: NTIS, PC A08/MF A01.

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Liquid redox sulfur recovery processes represent an important category of methods currently in use for removing H2S and recovering elemental sulfur from gaseous streams. The Gas Research Institute has been funding research on the complex chemistry of these processes in order to improve their performance and reliability and to evaluate the environmental effects of discharge streams. Since little information is publicly available about the environmental, health, and safety (EH&S) practices in operating plants, a questionnaire was developed to gather such information. The questionnaire addressed many of the data gaps in the literature and included five sections; general information, gaseous wastes and odors, liquid waste handling, sulfur and solid waste handling, and chemical handling/housekeeping/maintenance. The EH&S questionnaire was distributed to every liquid redox plant that could be identified from literature references and lists supplied by process vendors and from contacts made at GRI-sponsored liquid redox conferences. A total of 59 questionnaires were mailed to plants, and 20 completed questionnaires were returned. Based on the survey responses, the following areas have been recommended for further research: solution blowdown and disposal, sulfur purification, health and safety practices, and regulatory issues.

53668 (PB-90-261454/XAB) **Across North America Tracer Experiment (ANATEX). Model evaluation study. Final report.** Clark, T.L.; Cohn, R.D. Environmental Protection Agency, Research Triangle Park, NC (USA). Atmospheric Research and Exposure Assessment Lab. Jun 1990. 160p. (EPA-600/3-90/051). Source: NTIS, PC A08/MF A01.

Three perfluorocarbon tracer gases were released at 2.5-day or 5.0-day intervals from two sites in central North America and sampled for 24-hr periods at 77 surface sites. The source-receptor distances ranged from less than 30 km to 3,000 km. The data were used to evaluate the long-range transport and diffusion simulations of acid deposition models and to establish a range of uncertainty for various model genres. The performances of three single-layer Lagrangian, six multiple-layer Lagrangian, and two multiple-layer Eulerian models were assessed using quantifiable measures based on comparisons of ensemble mean concentrations and plume widths as well as trajectory errors expressed as a function of transport time. In general, the multiple-layer Lagrangian models performed best in simulating the transport of the tracers, while the Eulerian models performed best in simulating the ensemble concentration frequency distributions. After 0.5 day of transport, trajectory errors ranged from 100 km to 400 km; after 2.5 days, the errors ranged from 300 km to 800 km. Beyond 2.5 days, errors from four Lagrangian models plateaued, while errors for the other models continued to increase, peaking at nearly 1,100 km after 3.5 days.

53669 (PB-90-261470/XAB) **I/M test variability observed in the Louisville I/M program. Technical report.** Landman, L.C. Environmental Protection Agency, Ann Arbor, MI (USA). Emission Control Technology Div. Aug 1990. 56p. (EPA/AA/TSS/IM-90/7). Source: NTIS, PC A04/MF A01.

See also PB-90-250127.

271 vehicles from the 1981 through 1988 model years that failed their regularly scheduled I/M test received extra tests while still in the inspection lane. Those extra tests consisted of an immediate retest (i.e., a second chance test) and a similar test preceded by three minutes of 2500 rpm, no-load operation. Analysis of the test results shows that the three-minute, 2500 rpm, no-load preconditioning cycle added very little over simply an immediate retest for most of the vehicles in the study; however, that preconditioning cycle did have a significant effect in reducing the failure rate of those vehicles that exceeded only the HC standard on the initial test.

53670 (PB-90-261488/XAB) **User's manual for OZIPM-4 (Ozone Isopleth Plotting with Optional Mechanisms). Volume 1. Final report.** Environmental Protection Agency, Research Triangle Park, NC (USA). Office of Air Quality Planning and Standards. Jul 1989. 194p. (EPA-450/4-89/009A). Source: NTIS, PC A09/MF A02.

See also PB-90-255399.

The document describes each of the options in the OZIPM4 program and how to develop the input file needed to run the program.

53671 (PB-90-261827/XAB) **Fuel-efficient sewage sludge incineration. Final report, May 1987-September 1989.** Walsh, M.J.; Pincince, A.B.; Niessen, W.R. Camp Dresser and McKee, Inc., Boston, MA (USA). Aug 1990. 304p. Contract EPA-68-03-3346. Source: NTIS, PC A14/MF A02.

A study was performed to evaluate the status of incineration with low fuel use as a sludge disposal technology. The energy requirements, life-cycle costs, operation and maintenance requirements, and process capabilities of four sludge incineration facilities were evaluated. These facilities used a range of sludge thickening, conditioning, dewatering, and incineration technologies. The results provided realistic cost and energy requirements for a fuel-efficient sludge incineration facility and highlighted operational, managerial, and design features that contributed to the fuel efficiency of the incineration process. The information provides a basis for evaluating both the applicability of sludge incineration in future facilities and the cost and energy efficiency of existing incineration facilities.

53672 (PB-90-262825/XAB) **Radon diagnostics for schools. Report for January 1988-April 1990.** Leovic, K.W.; Craig, A.B.; Harris, D.B. Environmental Protection Agency, Research Triangle Park, NC (USA). Air and Energy Engineering Research Lab. 1990. 12p. (EPA-600/D-90/105). Source: NTIS, PC A03/MF A01.

The paper discusses a systematic approach to conducting radon diagnostics in schools. It provides those with radon mitigation experience in houses with an understanding of the major differences between schools and houses and how these differences influence radon diagnostics in schools. The diagnostic procedures and measurements discussed include: a review of all radon screening and confirmatory measurements; a review of all available building specifications and drawings such as structural, mechanical, and electrical; a building investigation to assess potential radon entry routes and to confirm and supplement information cited in the building plans; an analysis of the heating, ventilating, and air-conditioning (HVAC) system and its influence on pressure differentials and radon levels; and, most importantly for schools considering installation of a subslab depressurization system, the recommended approaches for measuring subslab pressure field extension. Radon diagnostic protocols for schools need to be more extensive than those applied in houses since schools are typically much larger than houses and often have complex structural details and HVAC systems.

53673 (PB-90-262841/XAB) **Deactivation by H_2S of Cr_2O_3 emission control catalyst for chlorinated VOC destruction. Report for July 1988-July 1989.** Narayanan, S.; Greene, H.L.; Nunez, C.M. Akron Univ., OH (USA). Dept. of Chemical Engineering. 1990. 21p. Grant EPA-R-815095. Source: NTIS, PC A03/MF A01.

The paper discusses one aspect of catalyst stability (i.e., deactivation by poisoning) and the concomitant effects on catalyst activity and selectivity in the destruction of chlorinated hydrocarbons. The study was initiated because nothing is documented of the effect of H_2S or the other sulfurous poisons on the performance of catalysts in the specific application of oxidative destruction of chlorinated volatile organic compounds (VOCs). A chromia (Cr_2O_3) catalyst, commercially popular for the destruction of chlorinated hydrocarbons, was chosen for the study of H_2S poisoning effects, which concentrated on the activity, selectivity, and stability trends of the catalyst to H_2S. Study results indicate that poisoning of the catalyst by H_2S brings about mixed effects. While activities generally decreased, the selectivities to HCl and chloroform became more favorable and the selectivity to CO_2 decreased.

53674 (PB-90-262858/XAB) **Computer model for calculating individual exposure due to indoor-air-pollution sources. Report for May 1989-January 1990.** Sparks, L.E.; Tucker, W.G. Environmental Protection Agency, Research Triangle Park, NC (USA). Air and Energy Engineering Research Lab. Jan 1990. 9p. (EPA-600/D-90/102). Source: NTIS, PC A02/MF A01.

The paper presents a model, EXPOSURE, for calculating individual exposure to indoor air pollutants from sources. The model calculates exposure due to individual, as opposed to population,

activity patterns and source use. The model uses data on source emissions, room-to-room air flows, air exchange with the outdoors, and indoor sinks to predict concentration/time profiles for all rooms. The concentration/time profiles are then combined with individual activity patterns to estimate exposure. The agreement between predicted concentration/time profiles and experimental data is excellent.

53675 (PB–90-262866/XAB) **Representing reversible sinks in indoor-air-quality models. Report for June 1989-February 1990.** Guo, Z.; Dunn, J.; Tichenor, B.; Mason, M.; Krebs, K. Acurex Corp., Research Triangle Park, NC (USA). Feb 1990. 9p. Contract EPA-68-02-4701. Source: NTIS, PC A02/MF A01.

The paper proposes two models of a reversible sink in an indoor environment. Based on simplified Langmuir assumptions, the kinetic model worked well with flat indoor surfaces such as wallboard, but it failed to predict the long-term, low-level re-emission from complex surfaces such as carpeting. The two-box model takes into account the slow mass transfer process and can be applied to both types of sink materials.

53676 (PB–90-262882/XAB) **What about when sub-slab depressurization doesn't work well.** Pyle, B.E.; Williamson, A.D.; Osborne, M.C. Southern Research Inst., Birmingham, AL (USA). 1990. 13p. Grant EPA-R-814621-01-0. Source: NTIS, PC A03/MF A01.

The paper discusses the mitigation of radon levels in basement houses when sub-slab depressurization (SSD), a widely used mitigation technique, is not a viable option. For example, in some houses the slab is poured directly on the soil, resulting in poor-to-nonexistent communication under the slab. To apply SSD requires elaborate plumbing and multiple suction holes in the slab. To develop viable alternatives, EPA has funded research to explore other radon mitigation options. Case studies include: basement pressurization with and without heat extraction, and filtration using charcoal. In the first, air from the upper portion of the house was forced into the basement, producing a pressure barrier at the slab/soil interface. In one house, heat was extracted from the upstairs using a heat pump to supply hot water for the occupants. In the second, a bed of charcoal was used to remove the radon gas. The charcoal bed was flushed with outdoor air to extract the radon before its complete decay to radon daughters.

53677 (PB–90-262890/XAB) **Development of AIRS:AMS transportation-emissions methodology. Report for December 1989-May 1990.** Kimbrough, E.S.; Ripberger, C.T.; Battye, R.E. Pechan (E.H.) and Associates, Inc., Durham, NC (USA). 1990. 15p. Contract EPA-68-D9-0168. Source: NTIS, PC A03/MF A01.

The paper discusses the National Emissions Data System (NEDS) Mobile Source methodology, the State Implementation Plan (SIP) Mobile Source methodology, differences and problems between the two methodologies, and the research program that will result in an improved Mobile Source methodology that will serve both the NEDS and SIP emission inventory objectives. The methodologies developed by the research program will reside in the Area and Mobile Source (AMS) Subsystem of the Aerometric Information Retrieval System (AIRS). EPA annually estimates emissions of the five criteria pollutants–particulates (TSP), SO2, NOx, reactive volatile organic compounds (VOCs), and CO. Historically, these emission estimates were stored in NEDS as point or area source emissions. Area sources usually include all mobile sources and any stationary sources to small, difficult, or numerous to classify as point sources. In NEDS, an area source is defined as a source that emits < 100 tons/year of a criteria pollutant. Areas that are in non-attainment with the National Ambient Air Quality Standards (NAAQS) are required to develop SIPs for use in the demonstration of progress toward meeting these standards. The major objectives of AIRS include providing storage and reporting capability for air quality, emissions, and enforcement data required by EPA regulations and the Clean Air Act.

53678 (PB–90-262908/XAB) **Effects of operating variables on PAH emissions and mutagenicity of emissions from woodstoves. Report for June 1987-May 1988.** McCrillis, R.C.; Watts, R.R.; Warren, S.H. Environmental Health Research and Testing, Inc., Research Triangle Park, NC (USA). 1990. 13p. Contract EPA-68-02-4277. Source: NTIS, PC A03/MF A01.

The paper discusses studies in instrumented woodstove test laboratories to quantify woodstove emissions during operations typical of in-house usage. (The studies parallel field source sampling to identify the potential mutagenic impact of residential wood burning on ambient and indoor air.) Three woodstoves were operated over a range of burnrates, burning eastern oak, southern yellow pine, or western white pine. Two conventional stoves were tested at an altitude of 90 m. One of the conventional stoves and a catalytic stove were tested at an altitude of 825 m. For one study, tests were started after a fire had been established and encompassed several wood additions over a 6-8 hr period. The other tests were started with kindling a fire in a cold stove and continued for about 8 hours, including several wood additions. For one test, emissions were collected using a modified EPA Method 5 sampling train. For the other tests, the woodstove dilution sampling system (WSDSS) was used. As anticipated, results showed wide variability, a common problem with woodstove testing. Total particulate emissions showed the expected inverse correlation with burnrate for the conventional stoves and nearly flat for the catalytic stove. While there seemed to be little or no correlation of total particulate emissions with altitude, the sum of the PAHs quantified showed an inverse correlation with altitude.

53679 (PB–90-262924/XAB) **Use of natural ventilation to control radon in single-family dwellings.** Cavallo, A.; Berkner, C.; Gadsby, K. Princeton Univ., NJ (USA). Center for Energy and Environmental Studies. 1990. 9p. Grant EPA-R-814673. Source: NTIS, PC A02/MF A01.

The paper discusses an examination of a fundamental assumption in radon mitigation work, that natural ventilation is not very effective in lowering indoor radon levels in buildings. (The mechanism by which ventilation acted to reduce radon levels was considered to be simple dilution; thus a factor of 10 increase in the air exchange rate would be required to reduce radon levels by this same factor.) The examination (in a natural ventilation experiment in a research house) showed that this assumption is fundamentally incorrect. Measuring the pressure field of a basement in conjunction with the building air exchange rate shows that ventilation reduces radon levels two ways: (1) by dilution, and (2) by modification of the pressure field of the building shell. The experiment indicates that effect (2) is much more important than (1)–dilution–and that natural ventilation can cause a much larger reduction in radon levels than was previously believed possible.

53680 (PB–90-262932/XAB) **Statistical analysis of weekly averaged radon levels in three residences over a complete year. Report for September 1989-February 1990.** Reddy, T.A.; Molineaux, F.B.; Socolow, R.H. Princeton Univ., NJ (USA). Center for Energy and Environmental Studies. 1990. 8p. Grant EPA-R-814673. Source: NTIS, PC A02/MF A01.

The paper gives results of a statistical analysis of weekly averaged indoor radon levels in three houses in the Princeton, NJ, area for which year-long continuous measurements of radon and other climatic and house parameters were available. It presents and discusses linear regression models of indoor radon, identified based on physical considerations rather than on those that yield the highest goodness-of-fit to actual data. Finally, certain aspects related to the experimental design of the instrumentation protocol are addressed.

53681 (PB–90-262940/XAB) **Planning for quality in radon mitigation. Report for September 1987-August 1988.** Yeager, W.M.; Ford, J.S.; Harris, D.B. Research Triangle Inst., Durham, NC (USA). 1990. 9p. Contract EPA-68-02-4291. Source: NTIS, PC A02/MF A01.

The paper describes the integration of quality assurance (QA) into each phase of radon mitigation: initial problem assessment, premitigation diagnostics, mitigation system specification and installation diagnostics, and post-mitigation diagnostics. During each phase, the interests and responsibilities of the different parties (individuals, companies, and governments) must be understood in order to ensure the quality of the installed mitigation system. Residential radon reduction requires that houses be individually

evaluated to identify the source(s) of radon, to select an appropriate mitigation technique, to design the mitigation system, and to confirm that the installed system is effective. A variety of measurements in addition to radon levels may be necessary to accomplish these objectives. QA practices and quality control (QC) procedures can be applied to ensure that sufficient information of known quality is available to make design decisions and that the final system is properly installed, safe, and effective.

53682 (PB–90-262957/XAB) **Air and pollutant movement in a building can be evaluated using CO as a surrogate.** Jackson, M.D.; Sparks, L.E.; Tichenor, B.A.; Guo, Z.; Krebs, K.A. Acurex Corp., Research Triangle Park, NC (USA). 1990. 9p. Contract EPA-68-02-4701. Source: NTIS, PC A02/MF A01.

The paper discusses tracer tests conducted to determine how indoor conditions may affect pollutant levels, prior to initiating a study of the indoor use of aerosol products. (NOTE: Aerosol product use indoors can cause elevated concentrations of vapor-phase organic compounds.) Carbon monoxide (CO) was chosen to represent gas-phase emissions from aerosol products. CO is easy to monitor over a range of 0-200 ppm, and background levels expected in indoor environments are quite low (<1-3 ppm). CO was released in the bathroom of a test house, and CO distribution throughout the house was followed under several scenarios, including: a bathroom vent fan on/off, the furnace fan on/off, doors open/closed, and windows open/closed. Because of the concentration of CO used, a safety plan was in effect during all tests. The ability to use CO as a surrogate was evaluated by using a commercially available home spot remover containing perchloroethylene (perc). The product was used per package directions and released in the same location and conditions used in the CO tests. The distribution of perc was followed using gas chromatography. The results of the air movement study and the evaluation of how well CO can serve as a surrogate are presented.

53683 (PB–90-262965/XAB) **Building HVAC/foundation diagnostics for radon mitigation in schools: Part 2. Technical session T-20.** Leovic, K.W.; Harris, D.B.; Craig, A.B.; Clarkin, M.; Turner, W.A. Camroden Associates, Rome, NY (USA). 1990. 10p. Contracts PR 0D0300NASA, PR 0D05010NALX. Source: NTIS, PC A02/MF A01.

The paper discusses a case study of radon diagnostics and mitigation procedures performed in a school researched by the U.S. EPA in New York State. It discusses building construction details, radon diagnostic measurements, mitigation system details, and post-mitigation radon levels. Elevated radon levels have been identified in school buildings throughout the U.S. and, as a result, the EPA has been researching radon reduction techniques for schools since early 1988. Initial research has addressed subslab depressurization, a successful radon reduction technique for many houses. Radon levels in schools can be influenced by the heating, ventilating, and air-conditioning (HVAC) system's effect on the pressure relationship of the building envelope. As a result, HVAC strategies for radon control have been used successfully in some schools.

53684 (PB–90-262981/XAB) **Evaluation of indoor-air-pollutant sinks for vapor-phase organic compounds. Report for June 1989-February 1990.** Tichenor, B.; Guo, Z.; Mason, M.; Dunn, J. Acurex Corp., Research Triangle Park, NC (USA). Environmental Systems Div. 1990. 9p. Contract EPA-68-02-4701. Source: NTIS, PC A02/MF A01.

The paper reports on small chamber tests and on the development of sink models based on fundamental mass transfer theory. The interaction of indoor air pollutants with interior surfaces (i.e., sinks) is a well known, but poorly understood phenomenon. Studies have shown that re-emissions of adsorbed organic vapors can contribute to elevated concentrations in indoor environments. Research is being conducted in small environmental test chambers to develop data for predicting sink behavior.

53685 (PB–90-263013/XAB) **Characterization of kerosene-heater emissions inside two mobile homes.** Burton, R.M.; Seila, R.A.; Wilson, W.E.; Pahl, D.A.; Mumford, J.L. Environmental Protection Agency, Research Triangle Park, NC (USA). Atmospheric Research and Exposure Assessment Lab. Mar 1990. 10p. (EPA–600/D-90/115). Source: NTIS, PC A02/MF A01.

In an effort to determine the impact of kerosene heater emissions on indoor air quality, measurements were made in and around two mobile homes at a rural mobile home park near Apex, NC. The sampling was performed at two single-wide mobile homes equipped with kerosene heaters. The concentrations of acidic aerosols and gases, fine and coarse particulate aerosol mass, carbon monoxide, nitrogen oxides, volatile organic compounds and semivolatiles, were determined for periods of heater operation and for periods in which heaters were not operated. Simultaneous outdoor measurements of acid aerosols and gases, fine and coarse aerosol mass, and volatile organic compounds were conducted to determine the contribution of outdoor pollutants to the indoor concentrations. Comparisons between the concentrations obtained from the analysis of outdoor, heater-on, and heater-off samples allowed the authors to examine the impacts of the kerosene emissions on indoor concentrations. Concentrations of sulfates, aerosol strong acidity, fine and coarse aerosol mass, carbon monoxide, and sulfur dioxide were found to be higher when the heater was operated; however, these heater-on concentrations were comparable to those observed in moderately polluted atmospheres. Indoor concentrations of nitrous acid and nitrogen oxides during heater operation were found to be considerably higher than those observed in polluted atmospheres. Finally, use of kerosene heaters was found to be responsible for increased concentrations of non-methane volatile and semi-volatile organic compounds indoors. Acid aerosol indoor concentrations were quite variable during the study and were found to exist in the presence of excess ammonia.

53686 (PB–90-263021/XAB) **Apportionment of residential indoor aerosol, VOC, and aldehyde species to indoor and outdoor sources.** Lewis, C.W.; Zweidinger, R.B.; Stevens, R.K. Environmental Protection Agency, Research Triangle Park, NC (USA). Atmospheric Research and Exposure Assessment Lab. 1990. 8p. (EPA–600/D-90/114). Source: NTIS, PC A02/MF A01.

The average concentrations of a large number of fine particle aerosol, VOC and aldehyde species measured in ten Boise, ID residences in wintertime have been apportioned according to their contributions from all inside sources and all outside sources. The method depends on the availability of average concentrations measured outside each residence during the same sampling periods used for the inside measurements, and on the ability to identify one or more species that have negligible indoor sources.

53687 (PB–90-263054/XAB) **Comparative analysis of dioxins and furans by electron impact, high-resolution mass spectrometry and by electron capture, negative ionization, low-resolution mass spectrometry.** Koester, C.J.; Harless, R.L.; Hites, R.A. Indiana Univ., Bloomington, IN (USA). 1990. 4p. Grant EPA-R-812588. Source: NTIS, PC A01/MF A01.

Electron impact, high resolution mass spectrometry (HRMS) is currently the method of choice for the analysis of polychlorinated dibenso-p-dioxins and dibenzofurans (PCDD/F) because of its ability to detect PCDD/F in the presence of interfering compounds, such as polychlorinated biphenyls (PCB), which cannot be resolved by low resolution methods. The PDCC/F analyses may also be performed using electron capture, negative ionization (ECNI) low resolution mass spectrometry, providing extensive sample preparation is done to remove interferences. Before ECNI low resolution mass spectrometry (MS) can be accepted as a routine method for PCDD/F analysis, it is necessary to show that results generated by this method are comparable to those obtained by HRMS. Known mixtures and unknown air samples were analyzed by electron impact HRMS (Finnigan MAT 90 system) and by ECNI low resolution MS (Hewlett Packard 5985B). Both instruments were fitted with a gas chromatographic inlet. The PCDD/F concentrations determined by the two techniques compare favorably, typically within 20%. The major difference between these two methods is that the ECNI low resolution method shows poor sensitivity in detecting 2,3,7,8-tetrachlorodioxin. However, ECNI MS offers the advantage of lower detection limits (50-100 fg) than electron impact HRMS (0.1 to 0.5 pg). These results suggest that ECNI low resolution MS can be a simple, low cost alternative to the common high resolution methods used for PCDD/F analysis.

53688 (PB–90-263104/XAB) **Durability of subslab depressurization radon-mitigation-system performance.** Gadsby, J.J.;

Harrje, D.T. Princeton Univ., NJ (USA). 1990. 9p. Source: NTIS, PC A02/MF A01.

The paper gives results of a review of the quarterly performance of subslab depressurization (SSD) radon mitigation systems in eight houses in the New Jersey (NJ) Piedmont study and houses in which the NJ Department of Environmental Protection measurements have indicated operation at above the U.S. EPA guideline of 4 pCi/L. Quarterly radon levels, mitigation system noise levels and flow rates, exhaust radon level, moisture problems, and other pertinent operating parameters are evaluated. Homeowner influence on the operation of the mitigation systems has been documented and was shown to be the major cause of above-guideline levels of radon in mitigated houses.

53689 (PB–90-263112/XAB) **Application of corona destruction as a method to control volatile organic compounds.** Ramsey, G.H.; Plaks, N.; Ponder, W.H.; Daniel, B.E.; Hamel, L.E. Acurex Corp., Research Triangle Park, NC (USA). 1990. 16p. Contract EPA-68-02-4701. Source: NTIS, PC A03/MF A01.

The paper discusses Environmental Protection Agency tests of two types of corona reactors. One makes use of a bed of ferroelectric pellets across which an alternating current electric field is impressed. The other develops corona between two electrodes that have been energized by a fast rise time (nanosecond range) electric field. Data from the experiments to date show that the destruction efficiency for toluene at optimum conditions was greater than 99% in both the packed-bed and the pulsed reactor and that the corona reaction occurs at ambient temperature.

53690 (PB–90-263179/XAB) **Unvented kerosene-heater emissions in mobile homes: Studies on indoor air particles, semivolatile organics, carbon monoxide, and mutagenicity.** Mumford, J.L.; Lewtas, J.; Burton, R.M.; Svendsgaard, D.B.; Houk, V.S. Environmental Protection Agency, Research Triangle Park, NC (USA). Health Effects Research Lab. 1990. 10p. (EPA–600/D-90/122). Source: NTIS, PC A02/MF A01.

The study was conducted to assess human exposure to air pollutants resulting from the use of kerosene heaters in mobile homes. It has been estimated that 15-17 million unvented kerosene heaters have been sold in the United States, and 33% of these heaters have been sold to mobile home residents. The emissions from kerosene heaters can result in high pollutants levels in mobile homes that have a small air volume and low ventilation rate. Indoor air exchange rate, temperature, and humidity were measured. Chemical analyses, including polycyclic aromatic hydrocarbon (PAH) and nitro PAH, also were performed on the indoor air samples from a selected home with the kerosene heater on and off. Increases in CO and organic concentrations resulting from the use of kerosene heaters were found in most homes monitored. Chemical analysis data also suggested the presence of evaporated, unburned kerosene fuel present in semivolatile organics collected in the XAD samples. When kerosene heaters were on, 56% of the sampling days (in all homes) showed dose-response mutagenic activity and 19% showed mutagenic activity on the heater-off days. In comparison with the U.S. national ambient air standards, four out of the eight heaters investigated in this study emitted pollutants that exceeded the ambient air standards some days. These data suggested that emissions from unvented kerosene heaters can significantly impact indoor air quality in mobile homes and that these emissions contain carcinogenic compounds and can be potentially carcinogenic in humans.

53691 (PB–90-263286/XAB) **Measurement of aerodynamic size and related risk assessment of airborne fibers.** Martonen, T.B. Environmental Protection Agency, Research Triangle Park, NC (USA). Health Effects Research Lab. 1990. 9p. (EPA–600/D-90/130). Source: NTIS, PC A02/MF A01.

The constituent particles of many ambient and workplace aerosols of health effects concerns are of fibrous and aggregate geometric shapes. The deposition sites of inhaled particles in the human respiratory system are primarily related to their aerodynamic diameters. Therefore, to assess potential exposure hazards it is necessary to have accurate kinetic classifications of airborne particulate matter. A tested theory of operation is given so centrifugal spectrometers can give direct and continuously graded measures of the aerodynamic size distributions of irregular aerosols. Aerosol centrifuge performance therefore can be customized to specific applications and be integrated into health effects studies.

53692 (PB–90-263294/XAB) **Ozone health effects and emerging issues in relation to standards setting.** Lippmann, M. New York Univ., NY (USA). Inst. of Environmental Medicine. ©1989. 14p. Grant EPA-R-811563. Source: NTIS, PC A03/MF A01.

Pub. in Atmospheric Ozone Research and Its Policy Implications, 21-35(1989). Portions of this document are not fully legible.

Our current knowledge of O_3 exposure and health effects is growing rapidly. Transient respiratory function effects accumulate throughout an exposure day, and ambient exposures have broad daily peaks. O_3 exposures also produce changes in airway inflammation and permeability. Healthy adults engaged for 1/2 hour in outdoor exercise show greater responses than those observed in chamber studies involving 1 or 2 hours of exposure, indicating potentiation of the O3 response by other environmental exposures. Acute animal studies show biochemical and structural responses to O_3 are potentiated by co-exposure to NO_2 and H_2SO_4. Chronic animal studies show that O_3 effects on lung structure accumulate, and several recent epidemiological studies suggest that cumulative functional effects are occurring in people. Recent research has also shown: (1) a seasonal variation in functional responsiveness in humans; (2) that a seasonal pattern of daily exposure in monkeys produces greater changes in the lung than a continuous pattern of daily exposures at the same concentration; and (3) that transient exposures produce persistent responses.

53693 (PB–90-263880/XAB) **Hazardous-waste TSDF: Technical guidance document for RCRA air-emission standards for process vents and equipment leaks. Final report.** Environmental Protection Agency, Research Triangle Park, NC (USA). Office of Air Quality Planning and Standards. Jul 1990. 395p. (EPA–450/3-89/021). Source: NTIS, PC A17/MF A03.

See also PB–90-103250.

On June 21, 1990, standards were promulgated to control organic air emissions from process vents and equipment leaks at hazardous waste treatment, storage, and disposal facilities. The standards were developed under Section 3004(n) of the Hazardous and Solid Waste Amendments to the Resource Conservation and Recovery Act (RCRA). The document is designed to provide technical guidance for RCRA permit writers and reviewers who will implement the standards.

53694 (PB–90-263930/XAB) **Commercial development of the ADVACATE process for flue-gas desulfurization. Report for August 1985-July 1990.** Sedman, C.B.; Maxwell, M.A.; Jozewicz, W.; Chang, J.C.S. Acurex Corp., Research Triangle Park, NC (USA). 1990. 10p. Contracts EPA-68-02-3988, EPA-68-02-4701. Source: NTIS, PC A02/MF A01.

The paper discusses the commercial development of the advanced silicate (ADVACATE) process for flue gas desulfurization (FGD). This commercialization follows several years of bench-scale sorbent development, pilot plant process optimization, and field pilot evaluation. Results are presented showing the importance of silica dissolution in preparation of calcium silicates. Pilot and field optimization and evaluation shows excellent potential for over 90% SO2 control at half the cost of conventional wet FGD processes. Projected costs and commercialization plans are presented.

53695 (PB–90-263971/XAB) **Effects of UV-B and global climate change on rice production: The EPA/IRRI Cooperative Research Plan.** Olszyk, D.M.; Ingram, K.T. Environmental Protection Agency, Corvallis, OR (USA). Environmental Research Lab. 1990. 32p. (EPA–600/D-90/143). Source: NTIS, PC A03/MF A01.

The US Environmental Protection Agency and International Rice Research Institute are initiating a cooperative program on the effects of UV-B and global climate change (increased CO_2 and temperature) on rice. Rice is the world's most important food crop and responds both to UV-B and climate change. The project will determine: (1) the effects of these stresses on the rice ecosystem, (2) the extent and intensity of those effects for Asia, (3) the importance of the rice ecosystem as a source of biogenic emissions such as methane and the impacts of environmental stress on those emissions, and (4) mitigation/adaptation options available to reduce any effects on rice yields and biogenic emissions.

53696 (PB–90-263997/XAB) **Pilot-scale evaluation of incinerating listed wastes from specific sources. Report for 1986-1988.** Dempsey, C.R.; Thurnau, R.C. Environmental Protection Agency, Cincinnati, OH (USA). Risk Reduction Engineering Lab. 1990. 14p. (EPA–600/D-90/141). Source: NTIS, PC A03/MF A01.

Pilot-Scale incineration testing was conducted at the United States Environmental Protection Agency's Incineration Research Facility (IRF) to support the development of best demonstrated available technology (BDAT) standards for the treatment of several hazardous wastes from specific sources (K-Wastes). All testing was conducted in the IRF's rotary kiln system. The paper summarizes the results of this testing for four of these wastes. The objective was to determine if these wastes could be incinerated by a well designed, well operated incinerator based on compliance with the hazardous waste incinerator regulations and to characterize the incineration residuals for hazardous constituents. It was found that these wastes could generally be incinerated in compliance with these regulations. However, the mist carryover from the air pollution control device would have to be more effectively controlled to meet the particulate standard in some cases. No detectable amounts of principle organic hazardous constituents (POHC's) were found in either the kiln ash or scrubber blowdown.

53697 (PB–90-265125/XAB) **Dendroecological analysis of relationships between growth of eastern white pine (Pinus strobus L.) and regional air pollution in the Eastern United States, using the forest data base. Final report, 1930-1980.** LeBlanc, D.C. Butler Univ., Indianapolis, IN (USA). Holcomb Research Inst. May 1989. 43p. Contract NPS-CX-0001-4-0058. (HRI–151). Source: NTIS, PC A03/MF A01.

Eastern white pine (Pinus strobus L.) has been described in the scientific literature as particularly sensitive to air pollution based on foliar injury symptoms, decreased growth, and increased mortality. Wide genotypic variability in tolerance of eastern white pine to air pollution has also been documented. Increment cores from 360 white pine were collected from a total of 24 sites in Tennessee, Virginia, Pennsylvania, Connecticut, Vermont, New Hampshire, and Maine as part of the FORAST (Forest Response to Anthropogenic Stress) project. The study analyzed the FORAST tree growth, air pollution, climate, and competition databases to determine if unexplained alterations in recent growth of white pine occur in a spatial/temporal pattern suggestive of air pollution effects. There is little evidence of widespread growth decline in this sample of white pine. Consistent with reports in the literature, regional mean BAI curves indicate growth has been constant or increasing from 1930 to 1980 for all regions sampled. However, a small proportion (9%) of the sample population exhibits post-1960 alterations in growth trends indicative of tree decline. Regional differences in tree age/size and recent stand dynamics obscured spatial patterns between incidence of tree decline and air pollution. Dendroclimatic analyses indicate white pine growth-climate relationships may have been altered at sites with high ozone exposure. Beginning in the 1950's, growth-climate correlations decrease markedly at high ozone exposure sites. However, the FORAST database has limitations that preclude a rigorous analysis of this potential ozone-climate interaction.

53698 (PNL–7471) **Climatological summary of wind and temperature data for the Hanford Meteorology Monitoring Network.** Glantz, C.S.; Schwartz, M.N.; Burk, K.W.; Kasper, R.B.; Ligotke, M.W.; Perrault, P.J. Pacific Northwest Lab., Richland, WA (USA). Sep 1990. 418p. Sponsored by U.S. DOE Environment Health & Safety. DOE Contract AC06-76RL01830. Order Number DE91000380. Source: NTIS, PC A18/MF A01 - OSTI; GPO Dep.

This document presents climatological summaries of wind and temperature data collected at the twenty-five monitoring stations operated by the Hanford Meteorology Monitoring Network. The climatological analyses presented here involve hourly averaged wind data collected over an 8-year period beginning in 1982 (fewer wind data are available for the several monitoring stations that began full-time operation after 1982) and hourly averaged air temperature data collected over 2-year period beginning in mid-1988. The tables and figures presented in this document illustrate the spatial and temporal variation of meteorological parameters across the Hanford Site and the surrounding areas. This information is useful for emergency response applications, routine meteorological forecasting, planning and scheduling operations, facility design, and environmental impact studies.

53699 (VTT-TUTK–683) **Vapour cloud modelling in the risk assessment of major toxic hazards - effect of relative humidity.** Kakko, R. (Valtion Teknillinen Tutkimuskeskus, Tampere (Finland). Turvallisuustekniikan Laboratorio). Valtion Teknillinen Tutkimuskeskus, Espoo (Finland). May 1990. 126p. Order Number DE91707464. Source: NTIS (US Sales Only), PC A07/MF A01.

During the last ten years there has been a considerable increase in the use of quantified risk assessment to achieve a detailed understanding of complex plants and for assisting decision making on safety matters stemming from the hazards associated with process. In risk assessments, a variety of predictive models is employed. The final results therefor contain uncertainties which arise from modelling imperfections or the adoptions of assumptions and judgements that are necessary to perform risk analysis. The paper illustrates the procedure required for a quantitative top-down analysis of risks from major toxic hazards to the individuals. The paper also indicates that many items of data or assumptions need to be incorporated. Particular attention is paid to the importance of relative humidity effects on consequence analysis. A computerised procedure developed within the Technical Research Centre of Finland is presented. The sensitivity of the results to assumptions and judgements and the validity and usefulness of the approach are discussed.

53700 (WHC-EP–0372-Vol.1) **Hanford Environmental Information System (HEIS) user's manual: Volume 1.** Westinghouse Hanford Co., Richland, WA (USA). Oct 1990. 438p. Sponsored by U.S. DOE Office of Administration and Human Resource Management. DOE Contract AC06-87RL10930. Order Number DE91000775. Source: NTIS, PC A19/MF A01 - OSTI; GPO Dep.

The Hanford Environmental Information System (HEIS) is used to store, manipulate, and retrieve the data that are gathered from many types of samples taken at the Hanford Site. The HEIS provides forms-based data entry, menu-driven user access software, data browsing facilities, and ad hoc querying. A multiwindowing computing environment is supported on the engineering workstation where a geographic information system (GIS) resides. A Sequent S27 UNIX-based multiprocessor computer and ORACLE are used for the central HEIS database. An integrated database, a GIS that allows data to be displayed on a map, and a support graphics capability allow users to generate spatially related visualizations and to perform data extractions for a complete picture of the pertinent data. In addition, the HEIS data can be moved to other software environments for further analysis and assessment. The purpose of the HEIS User's Manual is to describe and explain how to use the HEIS. The manual is intended to meet the needs of two types of user: The manager, engineer, or scientist who used the system for environmental monitoring, assessment, and restoration planning and the operational user, who is responsible for data processing, scheduling, data collection, and quality assurance. 23 refs.

53701 (WSRC-RP–89-313) **A climatological description of the Savannah River Site.** Hunter, C.H. Westinghouse Savannah River Co., Aiken, SC (USA). 22 May 1990. 101p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC09-89SR18035. Order Number DE91000508. Source: NTIS, PC A06/MF A01 - OSTI; GPO Dep.

This report provides a general climatological description of the Savannah River Site. The description provides both regional and local scale climatology. The regional climatology includes a general regional climatic description and presents information on occurrence frequencies of the severe meteorological phenomena that are important considerations in the design and siting of a facility. These phenomena include tornadoes, thunderstorms, hurricanes, and ice/snow storms. Occurrence probabilities given for extreme tornado and non-tornado winds are based on previous site specific studies. Local climatological conditions that are significant with respect to the impact of facility operations on the environment are described using on-site or near-site meteorological data. Summaries of wind speed, wind direction, and atmospheric stability are primarily based on the most recently generated five-year set of

data collected from the onsite meteorological tower network (1982–86). Temperature, humidity, and precipitation summaries include data from SRL's standard meteorological instrument shelter and the Augusta National Weather Service office at Bush Field through 1986. A brief description of the onsite meteorological monitoring program is also provided. 24 refs., 15 figs., 22 tabs.

53702 **Radometer: A portable field instrument for the rapid measurement of environmental radon and thoron.** Negro, V.C. (Environmental Measurements Lab., US DOE, New York, NY (US)). *IEEE Transactions on Nuclear Science (Institute of Electrical and Electronics Engineers) (USA)*, 37(2): 854-858 (Apr 1990). (CONF-900143–: Institute for Electronic and Electrical Engineers (IEEE) nuclear science symposium, San Francisco, CA (USA), 15-19 Jan 1990).

This paper reports on the Radometer, which measures radon and thoron by electrostatic collection of charged progeny on a surface barrier detector. Accurate measurements are made in only a few minutes because this instrument uses a dual electric field configuration, thus eliminating filters which slow the response time. An on board computer corrects for the effect of moisture and previous deposition to maintain accuracy and fast response when the instrument encounters high humidity and/or rapid changes in concentration. The instrument's detection volume is 6 L and its efficiency is 25% or .041 cpm per Bq m^{-3} (1.5 cpm per pCi L^{-1}).

53703 **Method for preconcentrating a sample for subsequent analysis.** Zaromb, S. To Dept. of Energy, Washington, DC (USA). USA Patent 4,942,135/A/. 17 Jul 1990. Filed date 14 Apr 1989. USA Patent patents application 7-337,983. Int. Cl. G01N 1/18. 4p. Source: Patent and Trademark Office, Box 9, Washington, DC 20232 (USA).

This patent describes a system for analysis of trace concentration of contaminants in air which includes a portable liquid chromatograph and a preconcentrator for the contaminants to be analyzed. The preconcentrator includes a sample bag having an inlet valve and an outlet valve for collecting an air sample. When the sample is collected the sample bag is connected in series with a sorbing apparatus in a recirculation loop. The sorbing apparatus has an inner gas-permeable container containing a sorbent material and an outer impermeable container. The sample is circulated through the outer container and around the inner container for trapping and preconcentrating the contaminants in the sorbent material. The sorbent materials may be a liquid having the same composition as the mobile phase of the chromatograph for direct injection thereinto. Alternatively, the sorbent material may be a porous, solid body, to which mobile phase liquid is added after preconcentration of the contaminants for dissolving the contaminants, the liquid solution then being withdrawn for injection into the chromatograph.

53704 **Real time infrared aerosol analyzer.** Johnson, S.A.; Reedy, G.T.; Kumar, R. To Dept. of Energy, Washington, DC (USA). USA Patent 4,942,297/A/. 17 Jul 1990. Filed date 18 Nov 1988. USA Patent patents application 7-273.395. Int. Cl. G01N 21/01. 3p. Source: Patent and Trademark Office, Box 9, Washington, DC 20232 (USA).

This patent describes apparatus for analyzing aerosols in essentially real time includes a virtual impactor which separates coarse particles from fine and ultrafine particles in an aerosol sample. The coarse and ultrafine particles are captured in PTFE filters, and the fine particles impact onto an internal light reflection element. The composition and quantity of the particles on the PTFE filter and on the internal reflection element are measured by alternately passing infrared light through the filter and the internal light reflection element, and analyzing the light through infrared spectrophotometry to identify the particles in the sample.

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Refer also to citation(s) 52663, 52664, 52665, 52666, 52667, 52671, 52672, 52673, 52743, 52744, 52745, 52746, 52802, 52816, 52817, 52818, 52819, 52820, 52821, 52822, 52823, 52824, 52825, 52826, 52827, 52828, 52829, 52830, 52831, 52832, 52833, 52834, 52835, 52836, 52837, 52838, 52839, 52840, 52841, 52842, 52856, 52878, 52884, 52888, 52889, 52890, 53370, 53645, 53650, 53654, 53699, 53700, 53768, 53771, 53772, 53776, 53777, 53778, 53779, 53814, 53845

53705 (DOE/EA–0642) **Operation of the Pinellas Plant Child Development Center/Partnership School: Environmental assessment: Environmental Health and Safety Programs.** General Electric Co., Largo, FL (USA). Neutron Devices Dept. 20 Jul 1990. 39p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00656. (GEPP-EV–1241). Order Number DE91000834. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The US Department of Energy Albuquerque Operations Office (DOE/AL), through the DOE Pinellas Area Office (PAO) and GE Neutron Devices (GEND), is proposing a joint venture to operate a Partnership School and Child Development Center at the Pinellas Plant. The Child Development Center/Partnership School proposal has been developed. The building has been constructed, teachers and staff selected, and the building made ready for immediate occupancy. The proposed action addressed by this environmental assessment is the operation and utilization of the school as a Partnership School, a preschool Child Development Center, and a before- and after-hours child care facility. In compliance with the National Environmental Policy Act of 1970, the potential impacts from the operation of the proposed action are assessed. Additionally, since the proposed school is located next to an industrial facility, impacts on the school population from routine plant operations, as well as abnormal events, are analyzed, and changes in plant operation that may be prudent are considered. 25 refs., 8 figs., 9 tabs.

53706 (DOE/ER/60933–1) **A theory of forest dynamics: Spatially explicit models and issues of scale: Progress report.** Pacala, S. Connecticut Univ., Storrs, CT (USA). [1990]. 3p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-90ER60933. Order Number DE91000825. Source: NTIS, PC A01/MF A01 - OSTI; GPO Dep.

Good progress has been made in the first year of DOE grant # FG02-90ER60933. The purpose of the project is to develop and investigate models of forest dynamics that apply across a range of spatial scales. The grant is one third of a three-part project. The second third was funded by the NSF this year and is intended to provide the empirical data necessary to calibrate and test small-scale ($\leq$1000 ha) models. The final third was also funded this year (NASA), and will provide data to calibrate and test the large-scale features of the models.

53707 (IPEN-PUB–147) **Profiles determination of Cesium-137 concentration in the main areas of Goiania radiological accident.** Rocca, H.C.C.; Aoki, P.E.; Enokihara, C.T.; Rostelato, M.; Lepki, V.; Bambalas, E. Instituto de Pesquisas Energeticas e Nucleares (IPEN), Sao Paulo, SP (Brazil). Jul 1988. 8p. (In Portuguese). Order Number DE91605702. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

This paper describes the profiles determination of cesium-137 concentration measured in function of depth and applied in seven areas considered as the main contamination focus. Since november 14th to december 17th 1987, 125 soil drillings were made and a total of 740 soil samples were prepared. Obtained data allowed to calculate the soil volume to be removed from contaminate areas. It was verified that after remotions the remaining activity was approximately 0,89Ci. (author).

53708 (PB–90-234741/XAB) **Response to comments background document for the Third Third land-disposal restrictions proposed rule November 22, 1989 (54 FR 48372). Volume 2-2. Capacity-related comments.** ICF, Inc., Fairfax, VA (USA). 8 May 1990. 275p. Source: NTIS, PC A12/MF A02.

See also Volume 2-1, PB–90-234733 and Volume 2-3, PB–90-234758. Portions of this document are not fully legible. Also available in set of 3 reports PC E99/MF E99, PB–90-234725.

On November 22, 1989, the Environmental Protection Agency (EPA, the Agency) proposed a rule to prohibit the land disposal of the final third of the schedule of restricted hazardous wastes, known as the Third Third (see 54 Federal Register 48372). The proposal outlined treatment standards and effective dates of prohibition for these wastes as well as for some First and Second Third soft hammer wastes, characteristic wastes, certain waste groups

(e.g., multi-source leachate, radioactive mixed waste), and newly listed wastes. The proposed rule was issued pursuant to the 1984 Hazardous and Solid Waste Amendments (HSWA) to the Resource Conservation and Recovery Act (RCRA). The Agency requested public comment on the proposal. The regulated community, environmental organizations, trade associations, State and Federal agencies, and concerned citizens submitted over 300 written letters on the proposed rule. EPA developed three volumes of a comment response document. This document (Volume 2 of 3) presents a summary of and responses to capacity-related comments received by the EPA docket clerk in response to the proposed rule. The comments have been divided into 17 chapters, each addressing specific comment categories. This volume contains Chapters 8-12. These chapters discuss mercury wastes, other metals, F, K, U, and P wastes, KO48-KO52 wastes, and deepwell injected wastes.

53709 (PB-90-234758/XAB) **Response to comments background document for the Third Third land-disposal restrictions proposed rule November 22, 1989 (54 FR 48372). Volume 2-3. Capacity-related comments.** ICF, Inc., Fairfax, VA (USA). 8 May 1990. 321p. Source: NTIS, PC A14/MF A02.

See also Volume 2-2, PB-90-234741. Portions of this document are not fully legible. Also available in set of 3 reports PC E99/MF E99, PB-90-234725.

On November 22, 1989, the Environmental Protection Agency (EPA, the Agency) proposed a rule to prohibit the land disposal of the final third of the schedule of restricted hazardous wastes, known as the Third Third (see 54 Federal Register 48372). The proposal outlined treatment standards and effective dates of prohibition for these wastes as well as for some First and Second Third soft hammer wastes, characteristic wastes, certain waste groups (e.g., multi-source leachate, radioactive mixed waste), and newly listed wastes. The proposed rule was issued pursuant to the 1984 Hazardous and Solid Waste Amendments (HSWA) to the Resource Conservation and Recovery Act (RCRA). The Agency requested public comment on the proposal. The regulated community, environmental organizations, trade associations, State and Federal agencies, and concerned citizens submitted over 300 written letters on the proposed rule. EPA developed three volumes of a comment response document. This document (Volume 2 of 3) presents a summary of and responses to capacity-related comments received by the EPA docket clerk in response to the proposed rule. The comments have been divided into 17 chapters, each addressing specific comment categories. This volume covers Chapters 13-17. The chapters discuss multisource leachates, radioactive waste, mixtures, lab packs, soil and debris, and miscellaneous capacity comments.

53710 (PB-90-234766/XAB) **Background document response to comments on the Third Third land-disposal restrictions proposed rule, November 22, 1989 (54 FR 48372). Volume 3. Policy-related comments.** Environmental Protection Agency, Washington, DC (USA). Office of Solid Waste. 8 May 1990. 461p. (EPA-530-SW-90-064). Source: NTIS, PC A20/MF A03.

On November 22, 1989, the Environmental Protection Agency (EPA, the Agency) proposed a rule to prohibit the land disposal of the final third of the schedule of restricted hazardous wastes, known as the Third Third. The proposal outlined treatment standards and effective dates of prohibition for these wastes as well as for some First and Second Third soft hammer wastes, characteristic wastes, certain waste groups (e.g., multisource leachate, radioactive mixed waste), and newly listed wastes. The proposed rule was issued pursuant to the 1984 Hazardous and Solid Waste Amendments (HSWA) to the Resource Conservation and Recovery Act (RCRA). The Agency requested public comment on the proposal. The regulated community, environmental organizations, trade associations, State and Federal agencies, and concerned citizens submitted over 300 written letters on the proposed rule. EPA developed three volumes of a comment response document. The document (Volume 3 of 3) presents a summary of and responses to comments received by the EPA docket clerk up to (and after) the end of the public comment period on January 8, 1990.

53711 (PB-90-242884/XAB) **Site Enforcement Tracking System (SETS): PRP listing by site for Connecticut.** Environmental Protection Agency, Washington, DC (USA). Office of Waste Programs Enforcement. 2 Aug 1990. 31p. Source: NTIS, PC A03/MF A01.

See also PB-90-242892. Also available in set of 6 reports PC E99/MF E99, PB-90-242876.

When expending Superfund monies at a CERCLA (Comprehensive Environmental Response, Compensation and Liability Act) site, EPA must conduct a search to identify parties with potential financial responsibility for remediation of uncontrolled hazardous waste sites. EPA regional Superfund Waste Management Staff issue a notice letter to the potentially responsible party (PRP). Data from this notice letter is used to form the Site Enforcement Tracking System (SETS). The data includes PRP name and address, a company contact person, the date the notice was issued, and the related CERCLA site name and identification number. SETS was created to track PRP identification at both NPL (National Priority List) and non-NPL sites. SETS does not address the range of other administrative duties related to tracking the PRP. These lists (updated quarterly) represent EPA's preliminary findings on the identities of potentially responsible parties. Inclusion on these lists does not constitute a final determination concerning the liability of any party for the hazard or contamination at any CERCLA site. The site report is designed to provide PRP information linked by the associated site, which appears according to Connecticut where the site is located.

53712 (PB-90-242892/XAB) **Site Enforcement Tracking System (SETS): PRP listing by site for Maine.** Environmental Protection Agency, Washington, DC (USA). Office of Waste Programs Enforcement. 2 Aug 1990. 69p. Source: NTIS, PC A04/MF A01.

See also PB-90-242884 and PB-90-242900. Also available in set of 6 reports PC E99/MF E99, PB-90-242876.

When expending Superfund monies at a CERCLA (Comprehensive Environmental Response, Compensation and Liability Act) site, EPA must conduct a search to identify parties with potential financial responsibility for remediation of uncontrolled hazardous waste sites. EPA regional Superfund Waste Management Staff issue a notice letter to the potentially responsible party (PRP). Data from this notice letter is used to form the Site Enforcement Tracking System (SETS). The data includes PRP name and address, a company contact person, the date the notice was issued, and the related CERCLA site name and identification number. SETS was created to track PRP identification at both NPL (National Priority List) and non-NPL sites. SETS does not address the range of other administrative duties related to tracking the PRP. These lists (updated quarterly) represent EPA's preliminary findings on the identities of potentially responsible parties. Inclusion on these lists does not constitute a final determination concerning the liability of any party for the hazard or contamination at any CERCLA site. The site report is designed to provide PRP information linked by the associated site, which appears according to Maine where the site is located.

53713 (PB-90-242900/XAB) **Site Enforcement Tracking System (SETS): PRP listing by site for Massachusetts.** Environmental Protection Agency, Washington, DC (USA). Office of Waste Programs Enforcement. 2 Aug 1990. 219p. Source: NTIS, PC A10/MF A02.

See also PB-90-242892 and PB-90-242918. Also available in set of 6 reports PC E99/MF E99, PB-90-242876.

When expending Superfund monies at a CERCLA (Comprehensive Environmental Response, Compensation and Liability Act) site, EPA must conduct a search to identify parties with potential financial responsibility for remediation of uncontrolled hazardous waste sites. EPA regional Superfund Waste Management Staff issue a notice letter to the potentially responsible party (PRP). Data from this notice letter is used to form the Site Enforcement Tracking System (SETS). The data includes PRP name and address, a company contact person, the date the notice was issued, and the related CERCLA site name and identification number. SETS was created to track PRP identification at both NPL (National Priority List) and non-NPL sites. SETS does not address the range of other administrative duties related to tracking the PRP. These lists (updated quarterly) represent EPA's preliminary findings on the identities of potentially responsible parties. Inclusion on these lists

does not constitute a final determination concerning the liability of any party for the hazard or contamination at any CERCLA site. The site report is designed to provide PRP information linked by the associated site, which appears according to Massachusetts where the site is located.

53714 (PB–90-242918/XAB) **Site Enforcement Tracking System (SETS): PRP listing by site for New Hampshire.** Environmental Protection Agency, Washington, DC (USA). Office of Waste Programs Enforcement. 2 Aug 1990. 109p. Source: NTIS, PC A06/MF A01.

See also PB–90-242900 and PB–90-242926. Also available in set of 6 reports PC E99/MF E99, PB–90-242876.

When expending Superfund monies at a CERCLA (Comprehensive Environmental Response, Compensation and Liability Act) site, EPA must conduct a search to identify parties with potential financial responsibility for remediation of uncontrolled hazardous waste sites. EPA regional Superfund Waste Management Staff issue a notice letter to the potentially responsible party (PRP). Data from this notice letter is used to form the Site Enforcement Tracking System (SETS). The data includes PRP name and address, a company contact person, the date the notice was issued, and the related CERCLA site name and identification number. SETS was created to track PRP identification at both NPL (National Priority List) and non-NPL sites. SETS does not address the range of other administrative duties related to tracking the PRP. These lists (updated quarterly) represent EPA's preliminary findings on the identities of potentially responsible parties. Inclusion on these lists does not constitute a final determination concerning the liability of any party for the hazard or contamination at any CERCLA site. The site report is designed to provide PRP information linked by the associated site, which appears according to New Hampshire where the site is located.

53715 (PB–90-242926/XAB) **Site Enforcement Tracking System (SETS): PRP listing by site for Rhode Island.** Environmental Protection Agency, Washington, DC (USA). Office of Waste Programs Enforcement. 2 Aug 1990. 32p. Source: NTIS, PC A03/MF A01.

See also PB–90-242918 and PB–90-242934. Also available in set of 6 reports PC E99/MF E99, PB–90-242876.

When expending Superfund monies at a CERCLA (Comprehensive Environmental Response, Compensation and Liability Act) site, EPA must conduct a search to identify parties with potential financial responsibility for remediation of uncontrolled hazardous waste sites. EPA regional Superfund Waste Management Staff issue a notice letter to the potentially responsible party (PRP). Data from this notice letter is used to form the Site Enforcement Tracking System (SETS). The data includes PRP name and address, a company contact person, the date the notice was issued, and the related CERCLA site name and identification number. SETS was created to track PRP identification at both NPL (National Priority List) and non-NPL sites. SETS does not address the range of other administrative duties related to tracking the PRP. These lists (updated quarterly) represent EPA's preliminary findings on the identities of potentially responsible parties. Inclusion on these lists does not constitute a final determination concerning the liability of any party for the hazard or contamination at any CERCLA site. The site report is designed to provide PRP information linked by the associated site, which appears according to Rhode Island where the site is located.

53716 (PB–90-242934/XAB) **Site Enforcement Tracking System (SETS): PRP listing by site for Vermont.** Environmental Protection Agency, Washington, DC (USA). Office of Waste Programs Enforcement. 2 Aug 1990. 11p. Source: NTIS, PC A03/MF A01.

See also PB–90-242926. Also available in set of 6 reports PC E99/MF E99, PB–90-242876.

When expending Superfund monies at a CERCLA (Comprehensive Environmental Response, Compensation and Liability Act) site, EPA must conduct a search to identify parties with potential financial responsibility for remediation of uncontrolled hazardous waste sites. EPA regional Superfund Waste Management Staff issue a notice letter to the potentially responsible party (PRP). Data from this notice letter is used to form the Site Enforcement Tracking System (SETS). The data includes PRP name and address, a company contact person, the date the notice was issued, and the related CERCLA site name and identification number. SETS was created to track PRP identification at both NPL (National Priority List) and non-NPL sites. SETS does not address the range of other administrative duties related to tracking the PRP. These lists (updated quarterly) represent EPA's preliminary findings on the identities of potentially responsible parties. Inclusion on these lists does not constitute a final determination concerning the liability of any party for the hazard or contamination at any CERCLA site. The site report is designed to provide PRP information linked by the associated site, which appears according to Vermont where the site is located.

53717 (PB–90-242942/XAB) **Site Enforcement Tracking System (SETS): PRP listing by site for Region 2.** Environmental Protection Agency, Washington, DC (USA). Office of Waste Programs Enforcement. 2 Aug 1990. 171p. Source: NTIS, PC EE99/MF E99.

Set includes PB–90-242959 through PB–90-242975.

A separate abstract is included for each of the 3 reports of this set.

53718 (PB–90-242959/XAB) **Site Enforcement Tracking System (SETS): PRP listing by site for New Jersey.** Environmental Protection Agency, Washington, DC (USA). Office of Waste Programs Enforcement. 2 Aug 1990. 128p. Source: NTIS, PC A07/MF A01.

See also PB–90-242942 and PB–90-242967. Also available in set of 3 reports PC E99/MF E99, PB–90-242942.

When expending Superfund monies at a CERCLA (Comprehensive Environmental Response, Compensation and Liability Act) site, EPA must conduct a search to identify parties with potential financial responsibility for remediation of uncontrolled hazardous waste sites. EPA regional Superfund Waste Management Staff issue a notice letter to the potentially responsible party (PRP). Data from this notice letter is used to form the Site Enforcement Tracking System (SETS). The data includes PRP name and address, a company contact person, the date the notice was issued, and the related CERCLA site name and identification number. SETS was created to track PRP identification at both NPL (National Priority List) and non-NPL sites. SETS does not address the range of other administrative duties related to tracking the PRP. These lists (updated quarterly) represent EPA's preliminary findings on the identities of potentially responsible parties. Inclusion on these lists does not constitute a final determination concerning the liability of any party for the hazard or contamination at any CERCLA site. The site report is designed to provide PRP information linked by the associated site, which appears according to New Jersey where the site is located.

53719 (PB–90-242967/XAB) **Site Enforcement Tracking System (SETS): PRP listing by site for New York.** Environmental Protection Agency, Washington, DC (USA). Office of Waste Programs Enforcement. 2 Aug 1990. 33p. Source: NTIS, PC A03/MF A01.

See also PB–90-242959 and PB–90-242975. Also available in set of 3 reports PC E99/MF E99, PB–90-242942.

When expending Superfund monies at a CERCLA (Comprehensive Environmental Response, Compensation and Liability Act) site, EPA must conduct a search to identify parties with potential financial responsibility for remediation of uncontrolled hazardous waste sites. EPA regional Superfund Waste Management Staff issue a notice letter to the potentially responsible party (PRP). Data from this notice letter is used to form the Site Enforcement Tracking System (SETS). The data includes PRP name and address, a company contact person, the date the notice was issued, and the related CERCLA site name and identification number. SETS was created to track PRP identification at both NPL (National Priority List) and non-NPL sites. SETS does not address the range of other administrative duties related to tracking the PRP. These lists (updated quarterly) represent EPA's preliminary findings on the identities of potentially responsible parties. Inclusion on these lists does not constitute a final determination concerning the liability of any party for the hazard or contamination at any CERCLA site.

The site report is designed to provide PRP information linked by the associated site, which appears according to New York where the site is located.

53720 (PB–90-242975/XAB) **Site Enforcement Tracking System (SETS): PRP listing by site for Puerto Rico.** Environmental Protection Agency, Washington, DC (USA). Office of Waste Programs Enforcement. 2 Aug 1990. 6p. Source: NTIS, PC A02/MF A01.

See also PB–90-242967. Also available in set of 3 reports PC E99/MF E99, PB–90-242942.

When expending Superfund monies at a CERCLA (Comprehensive Environmental Response, Compensation and Liability Act) site, EPA must conduct a search to identify parties with potential financial responsibility for remediation of uncontrolled hazardous waste sites. EPA regional Superfund Waste Management Staff issue a notice letter to the potentially responsible party (PRP). Data from this notice letter is used to form the Site Enforcement Tracking System (SETS). The data includes PRP name and address, a company contact person, the date the notice was issued, and the related CERCLA site name and identification number. SETS was created to track PRP identification at both NPL (National Priority List) and non-NPL sites. SETS does not address the range of other administrative duties related to tracking the PRP. These lists (updated quarterly) represent EPA's preliminary findings on the identities of potentially responsible parties. Inclusion on these lists does not constitute a final determination concerning the liability of any party for the hazard or contamination at any CERCLA site. The site report is designed to provide PRP information linked by the associated site, which appears according to Puerto Rico where the site is located.

53721 (PB–90-242983/XAB) **Site Enforcement Tracking System (SETS): PRP listing by site for Region 3.** Environmental Protection Agency, Washington, DC (USA). Office of Waste Programs Enforcement. 2 Aug 1990. 228p. Source: NTIS, PC EE99/MF E99.

Set includes PB–90-242991 through PB–90-243031.

A separate abstract is included for each of the 5 reports of this set.

53722 (PB–90-242991/XAB) **Site Enforcement Tracking System (SETS): PRP listing by site for Delaware.** Environmental Protection Agency, Washington, DC (USA). Office of Waste Programs Enforcement. 2 Aug 1990. 28p. Source: NTIS, PC A03/MF A01.

See also PB–90-243007. Also available in set of 5 reports PC E99/MF E99, PB–90-242983.

When expending Superfund monies at a CERCLA (Comprehensive Environmental Response, Compensation and Liability Act) site, EPA must conduct a search to identify parties with potential financial responsibility for remediation of uncontrolled hazardous waste sites. EPA regional Superfund Waste Management Staff issue a notice letter to the potentially responsible party (PRP). Data from this notice letter is used to form the Site Enforcement Tracking System (SETS). The data includes PRP name and address, a company contact person, the date the notice was issued, and the related CERCLA site name and identification number. SETS was created to track PRP identification at both NPL (National Priority List) and non-NPL sites. SETS does not address the range of other administrative duties related to tracking the PRP. These lists (updated quarterly) represent EPA's preliminary findings on the identities of potentially responsible parties. Inclusion on these lists does not constitute a final determination concerning the liability of any party for the hazard or contamination at any CERCLA site. The site report is designed to provide PRP information linked by the associated site, which appears according to Delaware where the site is located.

53723 (PB–90-243007/XAB) **Site Enforcement Tracking System (SETS): PRP listing by site for Maryland.** Environmental Protection Agency, Washington, DC (USA). Office of Waste Programs Enforcement. 2 Aug 1990. 22p. Source: NTIS, PC A03/MF A01.

See also PB–90-242991 and PB–90-243015. Also available in set of 5 reports PC E99/MF E99, PB–90-242983.

When expending Superfund monies at a CERCLA (Comprehensive Environmental Response, Compensation and Liability Act) site, EPA must conduct a search to identify parties with potential financial responsibility for remediation of uncontrolled hazardous waste sites. EPA regional Superfund Waste Management Staff issue a notice letter to the potentially responsible party (PRP). Data from this notice letter is used to form the Site Enforcement Tracking System (SETS). The data includes PRP name and address, a company contact person, the date the notice was issued, and the related CERCLA site name and identification number. SETS was created to track PRP identification at both NPL (National Priority List) and non-NPL sites. SETS does not address the range of other administrative duties related to tracking the PRP. These lists (updated quarterly) represent EPA's preliminary findings on the identities of potentially responsible parties. Inclusion on these lists does not constitute a final determination concerning the liability of any party for the hazard or contamination at any CERCLA site. The site report is designed to provide PRP information linked by the associated site, which appears according to Maryland where the site is located.

53724 (PB–90-243015/XAB) **Site Enforcement Tracking System (SETS): PRP listing by site for Pennsylvania.** Environmental Protection Agency, Washington, DC (USA). Office of Waste Programs Enforcement. 2 Aug 1990. 140p. Source: NTIS, PC A07/MF A01.

See also PB–90-243007 and PB–90-243023. Also available in set of 5 reports PC E99/MF E99, PB–90-242983.

When expending Superfund monies at a CERCLA (Comprehensive Environmental Response, Compensation and Liability Act) site, EPA must conduct a search to identify parties with potential financial responsibility for remediation of uncontrolled hazardous waste sites. EPA regional Superfund Waste Management Staff issue a notice letter to the potentially responsible party (PRP). Data from this notice letter is used to form the Site Enforcement Tracking System (SETS). The data includes PRP name and address, a company contact person, the date the notice was issued, and the related CERCLA site name and identification number. SETS was created to track PRP identification at both NPL (National Priority List) and non-NPL sites. SETS does not address the range of other administrative duties related to tracking the PRP. These lists (updated quarterly) represent EPA's preliminary findings on the identities of potentially responsible parties. Inclusion on these lists does not constitute a final determination concerning the liability of any party for the hazard or contamination at any CERCLA site. The site report is designed to provide PRP information linked by the associated site, which appears according to Pennsylvania where the site is located.

53725 (PB–90-243023/XAB) **Site Enforcement Tracking System (SETS): PRP site listing by site for Virginia.** Environmental Protection Agency, Washington, DC (USA). Office of Waste Programs Enforcement. 2 Aug 1990. 24p. Source: NTIS, PC A03/MF A01.

See also PB–90-243015 and PB–90-243031. Also available in set of 5 reports PC E99/MF E99, PB–90-242983.

When expending Superfund monies at a CERCLA (Comprehensive Environmental Response, Compensation and Liability Act) site, EPA must conduct a search to identify parties with potential financial responsibility for remediation of uncontrolled hazardous waste sites. EPA regional Superfund Waste Management Staff issue a notice letter to the potentially responsible party (PRP). Data from this notice letter is used to form the Site Enforcement Tracking System (SETS). The data includes PRP name and address, a company contact person, the date the notice was issued, and the related CERCLA site name and identification number. SETS was created to track PRP identification at both NPL (National Priority List) and non-NPL sites. SETS does not address the range of other administrative duties related to tracking the PRP. These lists (updated quarterly) represent EPA's preliminary findings on the identities of potentially responsible parties. Inclusion on these lists does not constitute a final determination concerning the liability of any party for the hazard or contamination at any CERCLA site. The site report is designed to provide PRP information linked by

the associated site, which appears according to Virginia where the site is located.

53726 (PB–90-243031/XAB) **Site Enforcement Tracking System (SETS): PRP listing by site for West Virginia.** Environmental Protection Agency, Washington, DC (USA). Office of Waste Programs Enforcement. 2 Aug 1990. 14p. Source: NTIS, PC A03/MF A01.

See also PB–90-243023. Also available in set of 5 reports PC E99/MF E99, PB–90-242983.

When expending Superfund monies at a CERCLA (Comprehensive Environmental Response, Compensation and Liability Act) site, EPA must conduct a search to identify parties with potential financial responsibility for remediation of uncontrolled hazardous waste sites. EPA regional Superfund Waste Management Staff issue a notice letter to the potentially responsible party (PRP). Data from this notice letter is used to form the Site Enforcement Tracking System (SETS). The data includes PRP name and address, a company contact person, the date the notice was issued, and the related CERCLA site name and identification number. SETS was created to track PRP identification at both NPL (National Priority List) and non-NPL sites. SETS does not address the range of other administrative duties related to tracking the PRP. These lists (updated quarterly) represent EPA's preliminary findings on the identities of potentially responsible parties. Inclusion on these lists does not constitute a final determination concerning the liability of any party for the hazard or contamination at any CERCLA site. The site report is designed to provide PRP information linked by the associated site, which appears according to West Virginia where the site is located.

53727 (PB–90-243205/XAB) **Site Enforcement Tracking System (SETS): PRP listing by site for Region 6.** Environmental Protection Agency, Washington, DC (USA). Office of Waste Programs Enforcement. 2 Aug 1990. 209p. Source: NTIS, PC EE99/MF E99.

See also PB–90-243213 through PB–90-243254.

A separate abstract is included for each of the 5 reports of this set.

53728 (PB–90-243213/XAB) **Site Enforcement Tracking System (SETS): PRP listing by site for Arkansas.** Environmental Protection Agency, Washington, DC (USA). Office of Waste Programs Enforcement. 2 Aug 1990. 16p. Source: NTIS, PC A03/MF A01.

See also PB–90-243221. Also available in set of 5 reports PC E99/MF E99, PB–90-243205.

When expending Superfund monies at a CERCLA (Comprehensive Environmental Response, Compensation and Liability Act) site, EPA must conduct a search to identify parties with potential financial responsibility for remediation of uncontrolled hazardous waste sites. EPA regional Superfund Waste Management Staff issue a notice letter to the potentially responsible party (PRP). Data from this notice letter is used to form the Site Enforcement Tracking System (SETS). The data includes PRP name and address, a company contact person, the date the notice was issued, and the related CERCLA site name and identification number. SETS was created to track PRP identification at both NPL (National Priority List) and non-NPL sites. SETS does not address the range of other administrative duties related to tracking the PRP. These lists (updated quarterly) represent EPA's preliminary findings on the identities of potentially responsible parties. Inclusion on these lists does not constitute a final determination concerning the liability of any party for the hazard or contamination at any CERCLA site. The site report is designed to provide PRP information linked by the associated site, which appears according to Arkansas where the site is located.

53729 (PB–90-243221/XAB) **Site Enforcement Tracking System (SETS): PRP listing by site for Louisiana.** Environmental Protection Agency, Washington, DC (USA). Office of Waste Programs Enforcement. 2 Aug 1990. 26p. Source: NTIS, PC A03/MF A01.

See also PB–90-243213 and PB–90-243239. Also available in set of 5 reports PC E99/MF E99, PB–90-243205.

When expending Superfund monies at a CERCLA (Comprehensive Environmental Response, Compensation and Liability Act) site, EPA must conduct a search to identify parties with potential financial responsibility for remediation of uncontrolled hazardous waste sites. EPA regional Superfund Waste Management Staff issue a notice letter to the potentially responsible party (PRP). Data from this notice letter is used to form the Site Enforcement Tracking System (SETS). The data includes PRP name and address, a company contact person, the date the notice was issued, and the related CERCLA site name and identification number. SETS was created to track PRP identification at both NPL (National Priority List) and non-NPL sites. SETS does not address the range of other administrative duties related to tracking the PRP. These lists (updated quarterly) represent EPA's preliminary findings on the identities of potentially responsible parties. Inclusion on these lists does not constitute a final determination concerning the liability of any party for the hazard or contamination at any CERCLA site. The site report is designed to provide PRP information linked by the associated site, which appears according to Louisiana where the site is located.

53730 (PB–90-243239/XAB) **Site Enforcement Tracking System (SETS): PRP listing by site for New Mexico.** Environmental Protection Agency, Washington, DC (USA). Office of Waste Programs Enforcement. 2 Aug 1990. 9p. Source: NTIS, PC A02/MF A01.

See also PB–90-243221 and PB–90-243247. Also available in set of 5 reports PC E99/MF E99, PB–90-243205.

When expending Superfund monies at a CERCLA (Comprehensive Environmental Response, Compensation and Liability Act) site, EPA must conduct a search to identify parties with potential financial responsibility for remediation of uncontrolled hazardous waste sites. EPA regional Superfund Waste Management Staff issue a notice letter to the potentially responsible party (PRP). Data from this notice letter is used to form the Site Enforcement Tracking System (SETS). The data includes PRP name and address, a company contact person, the date the notice was issued, and the related CERCLA site name and identification number. SETS was created to track PRP identification at both NPL (National Priority List) and non-NPL sites. SETS does not address the range of other administrative duties related to tracking the PRP. These lists (updated quarterly) represent EPA's preliminary findings on the identities of potentially responsible parties. Inclusion on these lists does not constitute a final determination concerning the liability of any party for the hazard or contamination at any CERCLA site. The site report is designed to provide PRP information linked by the associated site, which appears according to New Mexico where the site is located.

53731 (PB–90-243247/XAB) **Site Enforcement Tracking System (SETS): PRP listing by site for Oklahoma.** Environmental Protection Agency, Washington, DC (USA). Office of Waste Programs Enforcement. 2 Aug 1990. 69p. Source: NTIS, PC A04/MF A01.

See also PB–90-243239 and PB–90-243254. Also available in set of 5 reports PC E99/MF E99, PB–90-243205.

When expending Superfund monies at a CERCLA (Comprehensive Environmental Response, Compensation and Liability Act) site, EPA must conduct a search to identify parties with potential financial responsibility for remediation of uncontrolled hazardous waste sites. EPA regional Superfund Waste Management Staff issue a notice letter to the potentially responsible party (PRP). Data from this notice letter is used to form the Site Enforcement Tracking System (SETS). The data includes PRP name and address, a company contact person, the date the notice was issued, and the related CERCLA site name and identification number. SETS was created to track PRP identification at both NPL (National Priority List) and non-NPL sites. SETS does not address the range of other administrative duties related to tracking the PRP. These lists (updated quarterly) represent EPA's preliminary findings on the identities of potentially responsible parties. Inclusion on these lists does not constitute a final determination concerning the liability of any party for the hazard or contamination at any CERCLA site. The site report is designed to provide PRP information linked by

the associated site, which appears according to Oklahoma where the site is located.

53732 (PB–90-243254/XAB) **Site Enforcement Tracking System (SETS): PRP listing by site for Texas.** Environmental Protection Agency, Washington, DC (USA). Office of Waste Programs Enforcement. 2 Aug 1990. 89p. Source: NTIS, PC A05/MF A01.

See also PB–90-243247. Also available in set of 5 reports PC E99/MF E99, PB–90-243205.

When expending Superfund monies at a CERCLA (Comprehensive Environmental Response, Compensation and Liability Act) site, EPA must conduct a search to identify parties with potential financial responsibility for remediation of uncontrolled hazardous waste sites. EPA regional Superfund Waste Management Staff issue a notice letter to the potentially responsible party (PRP). Data from this notice letter is used to form the Site Enforcement Tracking System (SETS). The data includes PRP name and address, a company contact person, the date the notice was issued, and the related CERCLA site name and identification number. SETS was created to track PRP identification at both NPL (National Priority List) and non-NPL sites. SETS does not address the range of other administrative duties related to tracking the PRP. These lists (updated quarterly) represent EPA's preliminary findings on the identities of potentially responsible parties. Inclusion on these lists does not constitute a final determination concerning the liability of any party for the hazard or contamination at any CERCLA site. The site report is designed to provide PRP information linked by the associated site, which appears according to Texas where the site is located.

53733 (PB–90-243262/XAB) **Site Enforcement Tracking System (SETS): PRP listing by site for Region 7.** Environmental Protection Agency, Washington, DC (USA). Office of Waste Programs Enforcement. 2 Aug 1990. 209p. Source: NTIS, PC EE99/MF E99.

See also PB–90-243270 through PB–90-243303.

A separate abstract is included for each of the 4 reports of this set.

53734 (PB–90-243270/XAB) **Site Enforcement Tracking System (SETS): PRP listing by site for Iowa.** Environmental Protection Agency, Washington, DC (USA). Office of Waste Programs Enforcement. 2 Aug 1990. 25p. Source: NTIS, PC A03/MF A01.

See also PB–90-243288. Also available in set of 4 reports PC E99/MF E99, PB–90-243262.

When expending Superfund monies at a CERCLA (Comprehensive Environmental Response, Compensation and Liability Act) site, EPA must conduct a search to identify parties with potential financial responsibility for remediation of uncontrolled hazardous waste sites. EPA regional Superfund Waste Management Staff issue a notice letter to the potentially responsible party (PRP). Data from this notice letter is used to form the Site Enforcement Tracking System (SETS). The data includes PRP name and address, a company contact person, the date the notice was issued, and the related CERCLA site name and identification number. SETS was created to track PRP identification at both NPL (National Priority List) and non-NPL sites. SETS does not address the range of other administrative duties related to tracking the PRP. These lists (updated quarterly) represent EPA's preliminary findings on the identities of potentially responsible parties. Inclusion on these lists does not constitute a final determination concerning the liability of any party for the hazard or contamination at any CERCLA site. The site report is designed to provide PRP information linked by the associated site, which appears according to Iowa where the site is located.

53735 (PB–90-243288/XAB) **Site Enforcement Tracking System (SETS): PRP listing by site for Kansas.** Environmental Protection Agency, Washington, DC (USA). Office of Waste Programs Enforcement. 2 Aug 1990. 33p. Source: NTIS, PC A03/MF A01.

See also PB–90-243270 and PB–90-243296. Also available in set of 4 reports PC E99/MF E99, PB–90-243262.

When expending Superfund monies at a CERCLA (Comprehensive Environmental Response, Compensation and Liability Act) site, EPA must conduct a search to identify parties with potential financial responsibility for remediation of uncontrolled hazardous waste sites. EPA regional Superfund Waste Management Staff issue a notice letter to the potentially responsible party (PRP). Data from this notice letter is used to form the Site Enforcement Tracking System (SETS). The data includes PRP name and address, a company contact person, the date the notice was issued, and the related CERCLA site name and identification number. SETS was created to track PRP identification at both NPL (National Priority List) and non-NPL sites. SETS does not address the range of other administrative duties related to tracking the PRP. These lists (updated quarterly) represent EPA's preliminary findings on the identities of potentially responsible parties. Inclusion on these lists does not constitute a final determination concerning the liability of any party for the hazard or contamination at any CERCLA site. The site report is designed to provide PRP information linked by the associated site, which appears according to Kansas where the site is located.

53736 (PB–90-243296/XAB) **Site Enforcement Tracking System (SETS): PRP listing by site for Missouri.** Environmental Protection Agency, Washington, DC (USA). Office of Waste Programs Enforcement. 2 Aug 1990. 141p. Source: NTIS, PC A07/MF A01.

See also PB–90-243288 and PB–90-243304. Also available in set of 4 reports PC E99/MF E99, PB–90-243262.

When expending Superfund monies at a CERCLA (Comprehensive Environmental Response, Compensation and Liability Act) site, EPA must conduct a search to identify parties with potential financial responsibility for remediation of uncontrolled hazardous waste sites. EPA regional Superfund Waste Management Staff issue a notice letter to the potentially responsible party (PRP). Data from this notice letter is used to form the Site Enforcement Tracking System (SETS). The data includes PRP name and address, a company contact person, the date the notice was issued, and the related CERCLA site name and identification number. SETS was created to track PRP identification at both NPL (National Priority List) and non-NPL sites. SETS does not address the range of other administrative duties related to tracking the PRP. These lists (updated quarterly) represent EPA's preliminary findings on the identities of potentially responsible parties. Inclusion on these lists does not constitute a final determination concerning the liability of any party for the hazard or contamination at any CERCLA site. The site report is designed to provide PRP information linked by the associated site, which appears according to Missouri where the site is located.

53737 (PB–90-243304/XAB) **Site Enforcement Tracking System (SETS): PRP listing by site for Nebraska.** Environmental Protection Agency, Washington, DC (USA). Office of Waste Programs Enforcement. 2 Aug 1990. 10p. Source: NTIS, PC A02/MF A01.

See also PB–90-243296. Also available in set of 4 reports PC E99/MF E99, PB–90-243262.

When expending Superfund monies at a CERCLA (Comprehensive Environmental Response, Compensation and Liability Act) site, EPA must conduct a search to identify parties with potential financial responsibility for remediation of uncontrolled hazardous waste sites. EPA regional Superfund Waste Management Staff issue a notice letter to the potentially responsible party (PRP). Data from this notice letter is used to form the Site Enforcement Tracking System (SETS). The data includes PRP name and address, a company contact person, the date the notice was issued, and the related CERCLA site name and identification number. SETS was created to track PRP identification at both NPL (National Priority List) and non-NPL sites. SETS does not address the range of other administrative duties related to tracking the PRP. These lists (updated quarterly) represent EPA's preliminary findings on the identities of potentially responsible parties. Inclusion on these lists does not constitute a final determination concerning the liability of any party for the hazard or contamination at any CERCLA site. The site report is designed to provide PRP information linked by the associated site, which appears according to Nebraska where the site is located.

53738 (PB–90-243312/XAB) **Site Enforcement Tracking System (SETS): PRP listing by site for Region 8.** Environmental Protection Agency, Washington, DC (USA). Office of Waste Programs Enforcement. 2 Aug 1990. 108p. Source: NTIS, PC EE99/MF E99.

Set includes PB–90-243320 through PB–90-243379.

A separate abstract is included for each of the 6 reports of this set.

53739 (PB–90-243320/XAB) **Site Enforcement Tracking System (SETS): PRP listing by site for Colorado.** Environmental Protection Agency, Washington, DC (USA). Office of Waste Programs Enforcement. 2 Aug 1990. 65p. Source: NTIS, PC A04/MF A01.

See also PB–90-243338. Also available in set of 6 reports PC E99/MF E99, PB–90-243312.

When expending Superfund monies at a CERCLA (Comprehensive Environmental Response, Compensation and Liability Act) site, EPA must conduct a search to identify parties with potential financial responsibility for remediation of uncontrolled hazardous waste sites. EPA regional Superfund Waste Management Staff issue a notice letter to the potentially responsible party (PRP). Data from this notice letter is used to form the Site Enforcement Tracking System (SETS). The data includes PRP name and address, a company contact person, the date the notice was issued, and the related CERCLA site name and identification number. SETS was created to track PRP identification at both NPL (National Priority List) and non-NPL sites. SETS does not address the range of other administrative duties related to tracking the PRP. These lists (updated quarterly) represent EPA's preliminary findings on the identities of potentially responsible parties. Inclusion on these lists does not constitute a final determination concerning the liability of any party for the hazard or contamination at any CERCLA site. The site report is designed to provide PRP information linked by the associated site, which appears according to Colorado where the site is located.

53740 (PB–90-243338/XAB) **Site Enforcement Tracking System (SETS): PRP listing by site for Montana.** Environmental Protection Agency, Washington, DC (USA). Office of Waste Programs Enforcement. 2 Aug 1990. 13p. Source: NTIS, PC A03/MF A01.

See also PB–90-243320 and PB–90-243346. Also available in set of 6 reports PC E99/MF E99, PB–90-243312.

When expending Superfund monies at a CERCLA (Comprehensive Environmental Response, Compensation and Liability Act) site, EPA must conduct a search to identify parties with potential financial responsibility for remediation of uncontrolled hazardous waste sites. EPA regional Superfund Waste Management Staff issue a notice letter to the potentially responsible party (PRP). Data from this notice letter is used to form the Site Enforcement Tracking System (SETS). The data includes PRP name and address, a company contact person, the date the notice was issued, and the related CERCLA site name and identification number. SETS was created to track PRP identification at both NPL (National Priority List) and non-NPL sites. SETS does not address the range of other administrative duties related to tracking the PRP. These lists (updated quarterly) represent EPA's preliminary findings on the identities of potentially responsible parties. Inclusion on these lists does not constitute a final determination concerning the liability of any party for the hazard or contamination at any CERCLA site. The site report is designed to provide PRP information linked by the associated site, which appears according to Montana where the site is located.

53741 (PB–90-243346/XAB) **Site Enforcement Tracking System (SETS): PRP listing by site for North Dakota.** Environmental Protection Agency, Washington, DC (USA). Office of Waste Programs Enforcement. 2 Aug 1990. 7p. Source: NTIS, PC A02/MF A01.

See also PB–90-243338 and PB–90-243353. Also available in set of 6 reports PC E99/MF E99, PB–90-243312.

When expending Superfund monies at a CERCLA (Comprehensive Environmental Response, Compensation and Liability Act) site, EPA must conduct a search to identify parties with potential financial responsibility for remediation of uncontrolled hazardous waste sites. EPA regional Superfund Waste Management Staff issue a notice letter to the potentially responsible party (PRP). Data from this notice letter is used to form the Site Enforcement Tracking System (SETS). The data includes PRP name and address, a company contact person, the date the notice was issued, and the related CERCLA site name and identification number. SETS was created to track PRP identification at both NPL (National Priority List) and non-NPL sites. SETS does not address the range of other administrative duties related to tracking the PRP. These lists (updated quarterly) represent EPA's preliminary findings on the identities of potentially responsible parties. Inclusion on these lists does not constitute a final determination concerning the liability of any party for the hazard or contamination at any CERCLA site. The site report is designed to provide PRP information linked by the associated site, which appears according to North Dakota where the site is located.

53742 (PB–90-243353/XAB) **Site Enforcement Tracking System (SETS): PRP listing by site for South Dakota.** Environmental Protection Agency, Washington, DC (USA). Office of Waste Programs Enforcement. 2 Aug 1990. 4p. Source: NTIS, PC A01/MF A01.

See also PB–90-243346 and PB–90-243361. Also available in set of 6 reports PC E99/MF E99, PB–90-243312.

When expending Superfund monies at a CERCLA (Comprehensive Environmental Response, Compensation and Liability Act) site, EPA must conduct a search to identify parties with potential financial responsibility for remediation of uncontrolled hazardous waste sites. EPA regional Superfund Waste Management Staff issue a notice letter to the potentially responsible party (PRP). Data from this notice letter is used to form the Site Enforcement Tracking System (SETS). The data includes PRP name and address, a company contact person, the date the notice was issued, and the related CERCLA site name and identification number. SETS was created to track PRP identification at both NPL (National Priority List) and non-NPL sites. SETS does not address the range of other administrative duties related to tracking the PRP. These lists (updated quarterly) represent EPA's preliminary findings on the identities of potentially responsible parties. Inclusion on these lists does not constitute a final determination concerning the liability of any party for the hazard or contamination at any CERCLA site. The site report is designed to provide PRP information linked by the associated site, which appears according to South Dakota where the site is located.

53743 (PB–90-243361/XAB) **Site Enforcement Tracking System (SETS): PRP listing by site for Utah.** Environmental Protection Agency, Washington, DC (USA). Office of Waste Programs Enforcement. 2 Aug 1990. 14p. Source: NTIS, PC A03/MF A01.

See also PB–90-243353 and PB–90-243379. Also available in set of 6 reports PC E99/MF E99, PB–90-243312.

When expending Superfund monies at a CERCLA (Comprehensive Environmental Response, Compensation and Liability Act) site, EPA must conduct a search to identify parties with potential financial responsibility for remediation of uncontrolled hazardous waste sites. EPA regional Superfund Waste Management Staff issue a notice letter to the potentially responsible party (PRP). Data from this notice letter is used to form the Site Enforcement Tracking System (SETS). The data includes PRP name and address, a company contact person, the date the notice was issued, and the related CERCLA site name and identification number. SETS was created to track PRP identification at both NPL (National Priority List) and non-NPL sites. SETS does not address the range of other administrative duties related to tracking the PRP. These lists (updated quarterly) represent EPA's preliminary findings on the identities of potentially responsible parties. Inclusion on these lists does not constitute a final determination concerning the liability of any party for the hazard or contamination at any CERCLA site. The site report is designed to provide PRP information linked by the associated site, which appears according to Utah where the site is located.

53744 (PB–90-243379/XAB) **Site Enforcement Tracking System (SETS): PRP listing by site for Wyoming.** Environmental

Protection Agency, Washington, DC (USA). Office of Waste Programs Enforcement. 2 Aug 1990. 5p. Source: NTIS, PC A01/MF A01.

See also PB–90-243361. Also available in set of 6 reports PC E99/MF E99, PB–90-243312.

When expending Superfund monies at a CERCLA (Comprehensive Environmental Response, Compensation and Liability Act) site, EPA must conduct a search to identify parties with potential financial responsibility for remediation of uncontrolled hazardous waste sites. EPA regional Superfund Waste Management Staff issue a notice letter to the potentially responsible party (PRP). Data from this notice letter is used to form the Site Enforcement Tracking System (SETS). The data includes PRP name and address, a company contact person, the date the notice was issued, and the related CERCLA site name and identification number. SETS was created to track PRP identification at both NPL (National Priority List) and non-NPL sites. SETS does not address the range of other administrative duties related to tracking the PRP. These lists (updated quarterly) represent EPA's preliminary findings on the identities of potentially responsible parties. Inclusion on these lists does not constitute a final determination concerning the liability of any party for the hazard or contamination at any CERCLA site. The site report is designed to provide PRP information linked by the associated site, which appears according to Wyoming where the site is located.

53745 (PB–90-243387/XAB) **Site Enforcement Tracking System (SETS): PRP listing by site for Region 9.** Environmental Protection Agency, Washington, DC (USA). Office of Waste Programs Enforcement. 2 Aug 1990. 162p. Source: NTIS, PC EE99/MF E99.

Set includes PB–90-243395 through PB–90-243445.

No abstract available.

53746 (PB–90-243395/XAB) **Site Enforcement Tracking System (SETS): PRP listing by site for American Samoa.** Environmental Protection Agency, Washington, DC (USA). Office of Waste Programs Enforcement. 2 Aug 1990. 5p. Source: NTIS, PC A01/MF A01.

See also PB–90-243403. Also available in set of 6 reports PC E99/MF E99, PB–90-243387.

When expending Superfund monies at a CERCLA (Comprehensive Environmental Response, Compensation and Liability Act) site, EPA must conduct a search to identify parties with potential financial responsibility for remediation of uncontrolled hazardous waste sites. EPA regional Superfund Waste Management Staff issue a notice letter to the potentially responsible party (PRP). Data from this notice letter is used to form the Site Enforcement Tracking System (SETS). The data includes PRP name and address, a company contact person, the date the notice was issued, and the related CERCLA site name and identification number. SETS was created to track PRP identification at both NPL (National Priority List) and non-NPL sites. SETS does not address the range of other administrative duties related to tracking the PRP. These lists (updated quarterly) represent EPA's preliminary findings on the identities of potentially responsible parties. Inclusion on these lists does not constitute a final determination concerning the liability of any party for the hazard or contamination at any CERCLA site. The site report is designed to provide PRP information linked by the associated site, which appears according to American Samoa where the site is located.

53747 (PB–90-243403/XAB) **Site Enforcement Tracking System (SETS): PRP listing by site for Arizona.** Environmental Protection Agency, Washington, DC (USA). Office of Waste Programs Enforcement. 2 Aug 1990. 16p. Source: NTIS, PC A03/MF A01.

See also PB–90-243395 and PB–90-243411. Also available in set of 6 reports PC E99/MF E99, PB–90-243387.

When expending Superfund monies at a CERCLA (Comprehensive Environmental Response, Compensation and Liability Act) site, EPA must conduct a search to identify parties with potential financial responsibility for remediation of uncontrolled hazardous waste sites. EPA regional Superfund Waste Management Staff issue a notice letter to the potentially responsible party (PRP). Data from this notice letter is used to form the Site Enforcement Tracking System (SETS). The data includes PRP name and address, a company contact person, the date the notice was issued, and the related CERCLA site name and identification number. SETS was created to track PRP identification at both NPL (National Priority List) and non-NPL sites. SETS does not address the range of other administrative duties related to tracking the PRP. These lists (updated quarterly) represent EPA's preliminary findings on the identities of potentially responsible parties. Inclusion on these lists does not constitute a final determination concerning the liability of any party for the hazard or contamination at any CERCLA site. The site report is designed to provide PRP information linked by the associated site, which appears according to Arizona where the site is located.

53748 (PB–90-243411/XAB) **Site Enforcement Tracking System (SETS): PRP listing by site for California.** Environmental Protection Agency, Washington, DC (USA). Office of Waste Programs Enforcement. 2 Aug 1990. 126p. Source: NTIS, PC A07/MF A01.

See also PB–90-243403 and PB–90-243429. Also available in set of 6 reports PC E99/MF E99, PB–90-243387.

When expending Superfund monies at a CERCLA (Comprehensive Environmental Response, Compensation and Liability Act) site, EPA must conduct a search to identify parties with potential financial responsibility for remediation of uncontrolled hazardous waste sites. EPA regional Superfund Waste Management Staff issue a notice letter to the potentially responsible party (PRP). Data from this notice letter is used to form the Site Enforcement Tracking System (SETS). The data includes PRP name and address, a company contact person, the date the notice was issued, and the related CERCLA site name and identification number. SETS was created to track PRP identification at both NPL (National Priority List) and non-NPL sites. SETS does not address the range of other administrative duties related to tracking the PRP. These lists (updated quarterly) represent EPA's preliminary findings on the identities of potentially responsible parties. Inclusion on these lists does not constitute a final determination concerning the liability of any party for the hazard or contamination at any CERCLA site. The site report is designed to provide PRP information linked by the associated site, which appears according to California where the site is located.

53749 (PB–90-243429/XAB) **Site Enforcement Tracking System (SETS): PRP listing by site for Nevada.** Environmental Protection Agency, Washington, DC (USA). Office of Waste Programs Enforcement. 2 Aug 1990. 5p. Source: NTIS, PC A01/MF A01.

See also PB–90-243411 and PB–90-243437. Also available in set of 6 reports PC E99/MF E99, PB–90-243387.

When expending Superfund monies at a CERCLA (Comprehensive Environmental Response, Compensation and Liability Act) site, EPA must conduct a search to identify parties with potential financial responsibility for remediation of uncontrolled hazardous waste sites. EPA regional Superfund Waste Management Staff issue a notice letter to the potentially responsible party (PRP). Data from this notice letter is used to form the Site Enforcement Tracking System (SETS). The data includes PRP name and address, a company contact person, the date the notice was issued, and the related CERCLA site name and identification number. SETS was created to track PRP identification at both NPL (National Priority List) and non-NPL sites. SETS does not address the range of other administrative duties related to tracking the PRP. These lists (updated quarterly) represent EPA's preliminary findings on the identities of potentially responsible parties. Inclusion on these lists does not constitute a final determination concerning the liability of any party for the hazard or contamination at any CERCLA site. The site report is designed to provide PRP information linked by the associated site, which appears according to Nevada where the site is located.

53750 (PB–90-243437/XAB) **Site Enforcement Tracking System (SETS): PRP listing by site for Northern Marianas.** Environmental Protection Agency, Washington, DC (USA). Office of Waste Programs Enforcement. 2 Aug 1990. 5p. Source: NTIS, PC A01/MF A01.

See also PB–90-243429 and PB–90-243445. Also available in set of 6 reports PC E99/MF E99, PB–90-243387.

When expending Superfund monies at a CERCLA (Comprehensive Environmental Response, Compensation and Liability Act) site, EPA must conduct a search to identify parties with potential financial responsibility for remediation of uncontrolled hazardous waste sites. EPA regional Superfund Waste Management Staff issue a notice letter to the potentially responsible party (PRP). Data from this notice letter is used to form the Site Enforcement Tracking System (SETS). The data includes PRP name and address, a company contact person, the date the notice was issued, and the related CERCLA site name and identification number. SETS was created to track PRP identification at both NPL (National Priority List) and non-NPL sites. SETS does not address the range of other administrative duties related to tracking the PRP. These lists (updated quarterly) represent EPA's preliminary findings on the identities of potentially responsible parties. Inclusion on these lists does not constitute a final determination concerning the liability of any party for the hazard or contamination at any CERCLA site. The site report is designed to provide PRP information linked by the associated site, which appears according to Northern Mariana Islands where the site is located.

53751 (PB–90-243445/XAB) **Site Enforcement Tracking System (SETS): PRP listing by site for Trust Territories.** Environmental Protection Agency, Washington, DC (USA). Office of Waste Programs Enforcement. 2 Aug 1990. 5p. Source: NTIS, PC A01/MF A01.

See also PB–90-243437. Also available in set of 6 reports PC E99/MF E99, PB–90-243387.

When expending Superfund monies at a CERCLA (Comprehensive Environmental Response, Compensation and Liability Act) site, EPA must conduct a search to identify parties with potential financial responsibility for remediation of uncontrolled hazardous waste sites. EPA regional Superfund Waste Management Staff issue a notice letter to the potentially responsible party (PRP). Data from this notice letter is used to form the Site Enforcement Tracking System (SETS). The data includes PRP name and address, a company contact person, the date the notice was issued, and the related CERCLA site name and identification number. SETS was created to track PRP identification at both NPL (National Priority List) and non-NPL sites. SETS does not address the range of other administrative duties related to tracking the PRP. These lists (updated quarterly) represent EPA's preliminary findings on the identities of potentially responsible parties. Inclusion on these lists does not constitute a final determination concerning the liability of any party for the hazard or contamination at any CERCLA site. The site report is designed to provide PRP information linked by the associated site, which appears according to Trust Territories where the site is located.

53752 (PB–90-243452/XAB) **Site Enforcement Tracking System (SETS): PRP listing by site for Region 10.** Environmental Protection Agency, Washington, DC (USA). Office of Waste Programs Enforcement. 1990. 132p. Source: NTIS, PC EE99/MF E99.

Set includes PB–90-243460 through PB–90-243486.

A separate abstract is included for each of the 3 reports of this set.

53753 (PB–90-243460/XAB) **Site Enforcement Tracking System (SETS): PRP listing by site for Idaho.** Environmental Protection Agency, Washington, DC (USA). Office of Waste Programs Enforcement. 2 Aug 1990. 7p. Source: NTIS, PC A02/MF A01.

See also PB–90-243478. Also available in set of 3 reports, PC E99/MF E99, PB–90-243452.

When expending Superfund monies at a CERCLA (Comprehensive Environmental Response, Compensation and Liability Act) site, EPA must conduct a search to identify parties with potential financial responsibility for remediation of uncontrolled hazardous waste sites. EPA regional Superfund Waste Management Staff issue a notice letter to the potentially responsible party (PRP). Data from this notice letter is used to form the Site Enforcement Tracking System (SETS). The data includes PRP name and address, a company contact person, the date the notice was issued, and the related CERCLA site name and identification number. SETS was created to track PRP identification at both NPL (National Priority List) and non-NPL sites. SETS does not address the range of other administrative duties related to tracking the PRP. These lists (updated quarterly) represent EPA's preliminary findings on the identities of potentially responsible parties. Inclusion on these lists does not constitute a final determination concerning the liability of any party for the hazard or contamination at any CERCLA site. The site report is designed to provide PRP information linked by the associated site, which appears according to Idaho where the site is located.

53754 (PB–90-243478/XAB) **Site Enforcement Tracking System (SETS): PRP listing by site for Oregon.** Environmental Protection Agency, Washington, DC (USA). Office of Waste Programs Enforcement. 2 Aug 1990. 6p. Source: NTIS, PC A02/MF A01.

See also PB–90-243460 and PB–90-243486. Also available in set of 3 reports PC E99/MF E99, PB–90-243452.

When expending Superfund monies at a CERCLA (Comprehensive Environmental Response, Compensation and Liability Act) site, EPA must conduct a search to identify parties with potential financial responsibility for remediation of uncontrolled hazardous waste sites. EPA regional Superfund Waste Management Staff issue a notice letter to the potentially responsible party (PRP). Data from this notice letter is used to form the Site Enforcement Tracking System (SETS). The data includes PRP name and address, a company contact person, the date the notice was issued, and the related CERCLA site name and identification number. SETS was created to track PRP identification at both NPL (National Priority List) and non-NPL sites. SETS does not address the range of other administrative duties related to tracking the PRP. These lists (updated quarterly) represent EPA's preliminary findings on the identities of potentially responsible parties. Inclusion on these lists does not constitute a final determination concerning the liability of any party for the hazard or contamination at any CERCLA site. The site report is designed to provide PRP information linked by the associated site, which appears according to Oregon where the site is located.

53755 (PB–90-243486/XAB) **Site Enforcement Tracking System (SETS): PRP listing by site for Washington.** Environmental Protection Agency, Washington, DC (USA). Office of Waste Programs Enforcement. 2 Aug 1990. 119p. Source: NTIS, PC A06/MF A01.

See also PB–90-243478. Also available in set of 3 reports PC E99/MF E99, PB–90-243452.

When expending Superfund monies at a CERCLA (Comprehensive Environmental Response, Compensation and Liability Act) site, EPA must conduct a search to identify parties with potential financial responsibility for remediation of uncontrolled hazardous waste sites. EPA regional Superfund Waste Management Staff issue a notice letter to the potentially responsible party (PRP). Data from this notice letter is used to form the Site Enforcement Tracking System (SETS). The data includes PRP name and address, a company contact person, the date the notice was issued, and the related CERCLA site name and identification number. SETS was created to track PRP identification at both NPL (National Priority List) and non-NPL sites. SETS does not address the range of other administrative duties related to tracking the PRP. These lists (updated quarterly) represent EPA's preliminary findings on the identities of potentially responsible parties. Inclusion on these lists does not constitute a final determination concerning the liability of any party for the hazard or contamination at any CERCLA site. The site report is designed to provide PRP information linked by the associated site, which appears according to Washington where the site is located.

53756 (PB–90-260050/XAB) **Health assessment for Hewlett-Packard (620-640 Page Mill Road), Palo Alto, Santa Clara County, California, Region 9. CERCLIS No. CAD980884209. Preliminary report.** Agency for Toxic Substances and Disease Registry, Atlanta, GA (USA). 18 Jul 1990. 11p. Source: NTIS, PC A03/MF A01.

See also PB–90-118803.

The Hewlett-Packard (620-640 Page Mill Road) site was proposed for the National Priorities List on Update 7. The site is located on Page Mill Road in Palo Alto, California. Until 1986, the site was used as the location of an optoelectronic manufacturing operation. The site is currently vacant and will be converted into an office park complex. In 1981, waste solvents leaked out of an underground storage tank and contaminated the underlying soil and groundwater. The storage tank and some of the contaminated soil were excavated and disposed of off-site. An air stripping tower was constructed on-site to aid in the groundwater cleanup. The city of Palo Alto maintains several emergency water supply wells downgradient of the site. No site-related contamination has been reported in these public supply wells. The area surrounding the site is serviced by the public water system. However, there may be some private wells downgradient of the site. It is not known if these wells are currently being used for potable or nonpotable purposes or if they have been impacted by site-related contamination. In the absence of this information, it cannot be determined if the site poses a potential public health risk.

53757 (PB–90-260498/XAB) **Odorous compounds: Identification in tar-contaminated soil samples from manufactured gas plants. Topical report, September 1987-March 1989.** Roberson, C.L.; Menzie, C.; Cha, S.S.; Duffee, R.A. Atlantic Environmental Services, Inc., Colchester, CT (USA). Mar 1989. 43p. Contract GRI-5086-254-1333. Source: NTIS, PC A03/MF A01.

Odors from manufactured gas plant (MGP) sites may become noticeable when contaminated materials buried beneath the surface become exposed during site investigations, remediation or utility repairs. These odors may cause concern about potential health risks at the site. The primary objectives of the research were to identify the chemical compounds responsible for the characteristic MGP odor and to evaluate the potential health risks associated with the odors. A secondary objective was to assess the use of odor as a semi-quantitative tool for site investigations. The compounds most responsible for tarry odors were naphthalene derivatives, indene derivatives and thiophene derivatives; other odor compounds included alkanes, alkenes, furans and pyridines. Because naphthalene, indene and thiophene derivatives can be detected at concentrations below exposure standards for humans, they do not pose a health risk unless odors are very strong. However, because aromatic compounds often associated with tarry materials have higher odor detection limits, air monitoring is recommended (particularly if odors are aromatic in nature) to ensure that compliance with health standards is attained. Odor intensity can provide a semi-quantitative measure of relative tar concentrations, and can be a useful field tool during site investigations.

53758 (PB–90-261835/XAB) **Guidance documents relating to landfills and contaminants.** Schomaker, N.B.; Zunt, D.A. Environmental Protection Agency, Cincinnati, OH (USA). Risk Reduction Engineering Lab. 1990. 14p. (EPA–600/D-90/088). Source: NTIS, PC A03/MF A01.

The Environmental Protection Agency is developing and updating a series of Technical Guidance Documents to provide best engineering control technology to meet the needs of the Resource Conservation and Recovery Act (RCRA) and the Comprehensive Environmental Response Compensation and Liability Act (CERCLA), respectively. These documents are the compilation of the research efforts to date relating to containment of pollutants from waste disposal to the land as relates to residuals management. The specific areas of research being conducted under the RCRA land disposal program relates to laboratory, pilot and field validation studies in cover systems, waste leaching and solidification, liner systems and disposal facility evaluation. The specific areas of research being conducted under the CERCLA uncontrolled waste sites (Superfund) program relate to in situ treatment, solidification/stabilization for treating hazardous waste, combustion technologies, best demonstrated available technology (BDAT), on-site treatment technologies, emerging biosystems, expert systems, personnel health protection equipment, and site and situation assessment. The Guidance Documents are intended to assist both the regulated community and the permitting authorities, as well as the Program Offices, and Regions, as well as the states and other interested parties, with the latest information relevant to waste management.

53759 (PB–90-264862/XAB) **TCLP as a measure of treatment effectiveness.** Thurnau, R.C.; Esposito, M.P. Environmental Protection Agency, Cincinnati, OH (USA). Risk Reduction Engineering Lab. ©1989. 17p. (EPA–600/J-89/418). Source: NTIS, PC A03/MF A01.

Pub. in Hazardous Waste and Hazardous Materials, Vol. 6, No. 4, 347-361(1989).

The 1984 Hazardous and Solid Waste Amendments of the Resources Conservation and Recovery Act require that EPA either ban the disposal of hazardous wastes to the land or ascertain that such wastes are acceptable for land disposal. The soil and debris associated with the clean up of Superfund sites also fall under these statutes and must be addressed. A significant part of the regulatory strategy adopted by EPA involved the determination of best demonstrated available technology for contaminated soils and debris. A series of soil treatment technologies that were considered as candidates for Superfund sites (physical, chemical, thermal solidification) were tested on a laboratory prepared feed sample and the waste product streams generated were processed by the Toxicity Characteristic Leaching Procedure.

53760 (PB–90-269069/XAB) **Technology evaluation report: International Waste Technologies/Geo-Con in-situ stabilization/solidification. Volume 3. Update report. Final report, April 1988-January 1990.** Sawyer, S. Foster Wheeler Enviresponse, Inc., Edison, NJ (USA). Sep 1990. 54p. Contract EPA-68-03-3255. Source: NTIS, PC A04/MF A01.

See also PB–90-269085 and Volume 2, PB–89-194179 and Volume 4, PB–90-269077.

The long-term performance tests provide information on the first follow-up sampling and analysis on the SITE program demonstration of the International Waste Technologies additive, and the Geo-Con deep soil mixing equipment. The samples containing PCBs, were collected one year after the demonstration, and the chemical and physical test results were compared to those obtained during the demonstration. This was the first part of a 5-year monitoring program on this in-situ stabilization/solidification process. The demonstration was performed in April 1988 at an electric service shop in Hialeah, FL. Volume 3 discusses the results of the long-term monitoring tests and how they compare to the results of the demonstration.

53761 (PB–90-269077/XAB) **Technology evaluation report: International Waste Technologies/Geo-Con in-situ stabilization/solidification. Volume 4. Update report. Final report, April 1988-January 1990.** Sawyer, S. Foster Wheeler Enviresponse, Inc., Edison, NJ (USA). Sep 1990. 352p. Contract EPA-68-03-3255. Source: NTIS, PC A16/MF A02.

See also PB–90-269085 and Volume 3, PB–90-269069.

The long-term performance tests provide information on the first follow-up sampling and analysis on the SITE program demonstration of the International Waste Technologies additive, and the Geo-Con deep soil mixing equipment. The samples containing PCBs, were collected one year after the demonstration, and the chemical and physical test results were compared to those obtained during the demonstration. This was the first part of a 5-year monitoring program on this in-situ stabilization/solidification process. The demonstration was performed in April 1988 at an electric service shop in Hialeah, FL. Volume 4 contains the technical operating data–logs, laboratory analyses, and microstructural analyses.

53762 (PB–90-269085/XAB) **International Waste Technologies/Geo-Con in-situ stabilization/solidification: Applications analysis report.** Sawyer, S. Foster Wheeler Enviresponse, Inc., Edison, NJ (USA). Aug 1990. 92p. Contract EPA-68-03-3255. Source: NTIS, PC A05/MF A01.

See also PB–90-269077.

An evaluation was performed of the International Waste Technologies (IWT) HWT-20 additive and the Geo-Con, Inc. deep-soil-mixing equipment for an in situ stabilization/solidification process and its applicability as an on-site treatment method for waste site cleanup. A demonstration was held at a General Electric Co. electric service shop in Hialeah, Florida. Conclusions were reached concerning the technology's suitability for use in cleanups of various contaminants and at different locations. The conclusions

drawn from the available data are that: (1) immobilization of polychlorinated biphenyls (PCBs) appears likely, although due to low leachate concentrations for both the treated and untreated soils as a result of the low PCB concentrations in soil encountered in most of the tests, it cannot be confirmed; (2) heavy metals can probably be immobilized; (3) volatile organics can be reduced to low concentrations in treated soil leachates, but the ability to immobilize is not clear; and (4) a small volume increase on the order of magnitude of 5%-10% can be expected.

53763 (UBA-FB-90-009/16) **Testing and completion of a recording scheme for soil contaminations typical of various industrial sectors in abandoned sites in the Ruhr mining district. Abandoned-site file for the Gutehoffnungshuette steelworks, Oberhausen.** Umweltbundesamt, Berlin (Germany, F.R.); Technischer Ueberwachungs-Verein Rheinland e.V. (TUeV), Koeln (Germany, F.R.). Inst. fuer Energietechnik und Umweltschutz; Dortmund Univ. (Germany, F.R.). Inst. fuer Umweltschutz; Ecosystem GmbH, Duesseldorf (Germany, F.R.); Kommunalverband Ruhrgebiet, Essen (Germany, F.R.); Ministerium fuer Umwelt, Raumordnung und Landwirtschaft des Landes Nordrhein-Westfalen, Duesseldorf (Germany, F.R.). 1990. 76p. (In German). Contract UFOPLAN-Nr. 1090203402. Source: Copy held by UB/TIB Hannover.

This report contains a historical overiew of the activities executed in the investigated site. Possible soil contaminations may be due to boiler slag, cooling lubricating agents, wood preservatives, or galvanization wastes. (EF).

53764 (WHC-EP-0299) **Animal intrusion status report for fiscal year 1989.** Landeen, D.S. Westinghouse Hanford Co., Richland, WA (USA). Aug 1990. 77p. Sponsored by U.S. DOE Office of Environmental Restoration and Waste Management. DOE Contract AC06-87RL10930. Order Number DE91001289. Source: NTIS, PC A05/MF A01 - OSTI; GPO Dep.

The Protective Barrier and Warning Marker System Development Plan identified tasks that need to be completed to design a final protective barrier to implement in-place disposal of radioactive waste. This report summarizes the animal intrusion tasks that were conducted by Westinghouse Hanford Company in fiscal years 1988 and 1989 with respect to small mammals and water infiltration. 2 refs., 8 figs., 6 tabs.

53765 **Designing chemical soil characterization programs for mixed waste sites.** Meyers, K.A. Jr. (Jacobs Engineering Group, Inc., St. Charles, MO (USA)). pp. 531-533 of Waste processing, transportation, storage and disposal, technical programs and public education: Volume 2. Low-level waste. Post, R.G. Arizona Board of Regents, Tucson, AZ (USA) (1989). pp. 844 (CONF-890207--: Waste management '89: 15th international waste management symposium conference, Tucson, AZ (USA), 26 Feb - 2 mar 1989).

The Weldon Spring Site Remedial Action Project is a remedial action effort funded by the U.S. Department of Energy. The Weldon Spring Site, a former uranium processing facility, is located in east-central Missouri on a portion of a former ordnance works facility which produced trinitrotoluene during World War II. As a result of both uranium and ordnance production, the soils have become both radiologically and chemically contaminated. As a part of site characterization efforts in support of the environmental documentation process, a chemical soil characterization program was developed. This program consisted of biased and unbiased sampling program which maximized areal coverage, provided a statistically sound data base and maintained cost effectiveness. This paper discusses how the general rationale and processes used at the Weldon Spring Site can be applied to other mixed and hazardous waste sites.

53766 **Residual radioactive material guidelines: Methodology and applications.** Yu, C. (Argonne National Lab., IL (USA)); Yuan, Y.C.; Zielen, A.J.; Wallo, A. pp. 633-639 of Waste processing, transportation, storage and disposal, technical programs and public education: Volume 2. Low-level waste. Post, R.G. Arizona Board of Regents, Tucson, AZ (USA) (1989). pp. 844 DOE Contract W-31-109-ENG-38. (CONF-890207--: Waste management '89: 15th international waste management symposium conference, Tucson, AZ (USA), 26 Feb - 2 mar 1989).

A methodology to calculate residual radioactive material guidelines was developed for the U.S. Department of Energy (DOE). This methodology is coded in a menu-driven computer program, RESRAD, which can be run on IBM or IBM-compatible microcomputers. Seven pathways of exposure are considered: external radiation, inhalation, and ingestion of plant food, meat, milk, aquatic foods, and water. The RESRAD code has been applied to several DOE sites to calculate soil cleanup guidelines. This experience has shown that the computer code is easy to use and very user-friendly.

53767 **Effects of pH and adjuvants on clethodim photodegradation.** Falb, L.N. (Univ. of Georgia, Griffin (USA)); Bridges, D.C.; Smith, A.E. Jr. *Journal of Agricultural and Food Chemistry (USA)*, 38(3): 875-878 (Mar 1990). DOE Contract FG09-87ER13810.

Physical degradation of clethodim [2-[1-[[(3-chloro-2-propenyl)oxy]imino]propyl]-5-[2-(ethylthio)propyl]cyclohexan occurred in aqueous solution by acid catalysis and photocatalysis in in vitro experiments as assayed by HPLC. Clethodim degradation increased as acidity increased, being further accelerated under UV light with a half-life of 2.4, 2.6, and 3.2 h at pH 5, 6, and 7, respectively. Fewer degradation products were formed under UV plus adjuvant treatments, but the rate of photodegradation was increased by 2- to 7-fold over the UV control. The degradation rate in sunlight plus adjuvant treatments was enhanced by 7- to 27-fold over the sunlight control. The photodegradation rates in the presence of adjuvants followed the sequence LI700 > Dash > Agrioil > XE1167 > CC15943 > control. In summary, clethodim degradation was catalyzed by acid, the rate being accelerated in light (probably a different mechanism), and was further enhanced by the addition of adjuvants to the light treatment.

5403 Environmental Sciences, Aquatic

Refer also to citation(s) 52671, 52672, 52674, 52740, 52741, 52742, 52743, 52744, 52745, 52746, 52808, 52810, 52816, 52817, 52818, 52819, 52820, 52821, 52822, 52823, 52824, 52825, 52826, 52827, 52828, 52829, 52830, 52831, 52832, 52833, 52834, 52835, 52836, 52837, 52838, 52839, 52840, 52841, 52842, 52863, 53176, 53640, 53650, 53654, 53699, 53700, 53705, 53756

53768 (AD-A-223870/7/XAB) **Hazardous-waste technical-assistance survey, Little Rock Air Force Base, Arizona. Final report, 5 February-9 February 1990.** McMullen, P.T.; Hedgecock, N.S. Air Force Occupational and Environmental Health Lab., Brooks AFB, TX (USA). May 1990. 62p. (AFOEHL-90-091EQ00109EHB). Source: NTIS, PC A04/MF A01.

The scope of this survey was to address hazardous waste management practices, explore opportunities for hazardous waste minimization, and to determine possible industrial discharge to the sanitary sewer, the survey team performed a shop-by-shop evaluation of chemical waste management practices as well as met with hazardous waste managers and engineers to discuss the hazardous waste program. Recommendations include: (1) Move the 314 FMS AGE waste oil storage area to a site other than a washrack; (2) Construct a sink for neutralizing lead-acid batteries at 314 CES Power Production; (3) Contain and reuse triple-rinse water at 314 CES Entomology; (4) Use an alternate absorbent material rather than Speedy Dry; (5) Perform stripping operations at 189 ANG Corrosion Control in a tank rather than on the washrack.

53769 (DOE/ER/60246-T4) **[Hydrological and geochemical response and recovery in disturbed arctic ecosystems]: Progress report, January 1-August 1, 1990.** Everett, K.R. Ohio State Univ., Columbus, OH (USA). Byrd Polar Research Center. 31 Aug 1990. 87p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-84ER60246. Order Number DE91000898. Source: NTIS, PC A05/MF A01 - OSTI; GPO Dep.

Ionic concentration of snow prior to meltoff in 1990 as in previous years ranged widely from point to point within the basin. Overland flow began on May 12 and was monitored at

closely-spaced time intervals for discharge volume and ionic concentrations to better define this relationship in non-channelized flow. Ionic concentration in both watertrack flow and in Imnavait Creek were closely monitored during meltoff. During the post melt period daily sampling was maintained in watertrack 7 and Imnavait Creek. Rainfall collection and analysis on an eight day schedule was maintained as in previous years. Soil solution composition was monitored on an event basis in conjunction with a similar schedule of precipitation sampling to determine relationships between precipitation and near surface and overland flow. Composition of deeper soil solution was also monitored and sampled for ^{18}O analyses to determine the age structure of water contributed by the active layer to stream and watertracks. A pilot experiment employing salt tracers was conducted across landscape units to determine rates and pathways of soil solution movement in response to individual rain events. Nutrient addition in rime and fog were also recorded to add detail to the input side of the balance equation.

53770 (EIS/EA-MMS–90-0029-Vol.1) **Proposed marine mineral lease sale: Exclusive economic zone adjacent to Hawaii and Johnston Island: Volume 1: Final environmental impact statement.** Minerals Management Service, Herndon, VA (USA). Office of Strategic and International Minerals; Hawaii Dept. of Business and Economic Development, Honolulu, HI (USA). Aug 1990. 503p. Sponsored by U.S. Department of the Interior; State of Hawaii. Source: OSTI; US Department of the Interior, Minerals Management Service, Office of Strategic and International Minerals, 381 Elden Street, MS 649, Herndon, VA 22070.

This Environmental Impact Statement (EIS) analyzes the potential effects of leasing mineral rights to marine deposits of hard mineral resources. These deposits are located within the Exclusive Economic Zone (EEZ) of the United States and consist of layered manganese and iron oxide crusts. The crusts contain potentially economic concentrations of cobalt, nickel, and other metals. The Federal government is proposing to offer mineral leases under the Outer Continental Shelf Lands Act. This act is administered by the Department of the Interior, Minerals Management Service (MMS). The State of Hawaii has participated in this effort through a unique joint task force which has supervised the drafting of the EIS under the guidance of the MMS Office of Strategic and International Minerals (OSIM). The State and the Department of the Interior will continue this involvement through the recently established cooperative agreement for joint planning and review of marine mineral matters. Impacts examined in this EIS include those associated with the selection of mine sites available in a lease tract, the testing of mining system components in the lease tract, and the commercial mining and metallurgical processing of the ore for a period of twenty years. Existing markets for the metals in these deposits indicate that only one such operation will be viable in the foreseeable future. Because of the uncertainties related to the constantly changing technologies of mining and processing and the lack of definition of specific mining sites, this EIS assumes that site-specific impact assessments will be completed for all commercial mining and processing plans. This phased approach to project development is consistent with the existing regulations.

53771 (KFK-PEF–69) **Impact of atmospheric input on soil water, surface runoff, and groundwater in the Bunter Sandstone region of the Black Forest (Southern Germany).** Einsele, G. (Tuebingen Univ. (Germany, F.R.). Inst. und Museum fuer Geologie und Palaeontologie); Ehmann, M.; Irouschek, T. Kernforschungszentrum Karlsruhe GmbH (Germany, F.R.). Projekt Europaeisches Forschungszentrum fuer Massnahmen zur Luftreinhaltung (PEF). Jun 1990. 100p. (In German). Contract PEF 84/006/1A. Order Number DE91717160. Source: NTIS (US Sales Only), PC A05/MF A01.

In 1986 and 1987 nine forested catchments were investigated in the Bunter Sandstone area of the Black Forest. Near-surface runoff and interflow have a composition similar to canopy throughfall water (mainly spruce). Nitrate and sulfate concentrations of all runoff components indicate a distinct regional pattern, which coincides with that found for the constituents of acid rain. During storm events, shallow circulating waters have increased concentrations of nitrate and sulfate as well as low pH values. Springs from periglacial layers partially show low pH troughout the year. Significant chemical alterations do not become evident until the water has passed the sandstone aquifer. Deeply circulating spring waters exhibit a state in the HCO_3-buffer system and positive alkalinities. The mean residence time of these waters is on the order of several months to a few years. Even the soils in the carbonate-bearing Upper Bunter sandstone display low pH values and a state in the Al-buffer system. In spite of the fact that Ca + Mg still contribute 10-30% of the exchangeable cations, infiltrating water moving on macropores maintains its acid nature. But somewhat deeper circulating waters are easily neutralized. In catchments free of carbonate (Middle part of Bunter sandstone), higher levels of calcium and magnesium in groundwater and lower concentrations of hydrogen carbonate show the effects of cation exchange and increased weathering of silicates. Due to great differences in precipitation, balance calculations of input and output show a regional pattern which does not coincidence with that of the measured concentrations of various species in rain water and runoff. At present, sulfate is stored in the soil zone of most of the investigated catchments. However, in the area most affected by air pollution, more sulfate is released from the soils than replaced by rain and dry deposition. (orig./EF).

53772 (LA–11851-MS) **Runoff and sediment yield model for predicting nuclide transport in watersheds using BIOTRAN.** Gallegos, A.F.; Wenzel, W.J. Los Alamos National Lab., NM (USA). Sep 1990. 118p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-36. Order Number DE91000061. Source: NTIS, PC A06/MF A01 - OSTI; GPO Dep.

The environmental risk simulation model BIOTRAN was interfaced with a series of new subroutines (RUNOFF, GEOFLX, EROSON, and AQUIFER) to predict the movement of nuclides, elements, and pertinent chemical compounds in association with sediments through lateral and channel flow of runoff water. In addition, the movement of water into and out of segmented portions of runoff channels was modeled to simulate the dynamics of moisture flow through specified aquifers within the watershed. The BIOTRAN soil water flux subroutine, WATFLX, was modified to interface the relationships found in the SPUR model for runoff and sediment transport into channels with the particle sorting relationships to predict radionuclide enrichment and movement in watersheds. The new subroutines were applied specifically to Mortandad Canyon within Los Alamos National Laboratory by simultaneous simulation of eight surface vegetational subdivisions and associated channel and aquifer segments of this watershed. This report focuses on descriptions of the construction and rationale for the new subroutines and on discussing both input characteristics and output relationships to known runoff events from Mortandad Canyon. Limitations of the simplified input on model behavior are also discussed. Uranium-238 was selected as the nuclide for demonstration of the model because it could be assumed to be homogeneously distributed over the watershed surface. 22 refs., 18 figs., 9 tabs.

53773 (MIC–90-04397/XAB) **Transfer of suspended particles from liquid effluents of nuclear generating stations through the environment. Report No. INFO-0324.** Devereaux, F.J. Atomic Energy Control Board, Ottawa, ON (Canada). ©1989. 26p. Source: NTIS, PC EE07/MF E01.

Due to the complexity of the environmental transfer of suspended particles in aquatic systems, the available literature usually deals with specific pathways and mechanisms of the transfer process. This paper gives a brief overview of the entire transfer process, including potential routes of transfer in both the marine and freshwater environments, and tentative conclusions.

53774 (PB–90-214966/XAB) **Drinking-water criteria document for polycyclic aromatic hydrocarbons (PAHs). Draft report (Final).** Schoeny, R.; O'Flaherty, E. Environmental Protection Agency, Cincinnati, OH (USA). Office of Environmental Criteria and Assessment. Sep 1988. 311p. (ECAO-CIN-D–010). Source: NTIS, PC A14/MF A02.

Portions of this document are not fully legible.

The contents of this study includes the following: physical and chemical properties; toxicokinetics; human exposure; health effects in animals; health effects in humans; mechanisms of toxicity; and quantification of toxicological effects.

53775 (PB–90-237132/XAB) **Environmental statistics. Bibliographic series.** Environmental Protection Agency, Washington, DC (USA). Office of Information Resources Management. Feb 1990. 112p. (EPA/IMSD–90/002). Source: NTIS, PC A06/MF A01.

See also PB–90-237140.

The bibliography has pulled together citations from a wide range of recent documents and includes references that may be of interest to the statistical community and to environmentalists. Citations in the bibliography were selected for their relevance to EPA's environmental statistics effort and include references to books, journal articles, government reports and conference papers. The bibliography is organized according to the following program areas: general (interdisciplinary), air, water, hazardous waste, radiation, and risk assessment. The citations cover a period from 1987 through March 1990.

53776 (PB–90-255522/XAB) **Major hazard control: A practical manual. An ILO contribution to the international programme on chemical safety of UNEP, ILO, WHO (IPCS).** Fisher, R. International Labour Organization, Geneva (Switzerland). 1988. 279p. Source: NTISPC$31.50.

U.S., Canada and Mexico sales only. All others International Labor Office, Publications Department, CH 1211, Geneva Switzerland.

The manual aims at assisting all countries that are considering major hazard control. The publication will be of particular interest to those who manage major hazard installations, to unions and municipal authorities, including police and fire departments, hospitals and emergency units. The manual is designed to deal with the safety aspects of siting, planning, design, construction and operations of plants. A chapter describes the prerequisites for a hazard control system, including staffing and equipment requirements and sources of information. There are eight appendices and 10 tables to explain some parts of the text and to provide examples of information mentioned therein.

53777 (PB–90-263088/XAB) **Modeling geochemical processes attenuating inorganic contaminant transport in the subsurface region: Implementing adsorption processes, March 1990.** Loux, N.T.; Brown, D.S.; Chafin, C.R.; Allison, J.D.; Hassan, S.M. Environmental Protection Agency, Athens, GA (USA). Environmental Research Lab. 1990. 21p. (EPA–600/D-90/118). Source: NTIS, PC A03/MF A01.

See also PB–90-116781.

The capability of an equilibrium speciation model, MINTEQA2, for estimating total dissolved (and, hence, mobile) metals concentrations in the saturated zone below hazardous waste disposal sites was evaluated in laboratory studies. Emphasis was placed on testing the geochemical speciation portion of the model.

53778 (PB–90-263211/XAB) **Determination of biodegradability kinetics of RCRA compounds using respirometry for structure-activity relationships.** Tabak, H.H.; Desai, S.; Govind, R. Environmental Protection Agency, Cincinnati, OH (USA). Risk Reduction Engineering Lab. ©1990. 21p. (EPA–600/D-90/136). Source: NTIS, PC A03/MF A01.

Electrolytic respirometry is attaining prominence in biodegradation studies and is becoming one of the more suitable experimental methods for measuring the biodegradability and the kinetics of biodegradation of toxic organic compounds by the sewage, sludge, and soil microbiota and for determining substrate inhibitory effects to microorganisms in wastewater treatment systems. The purpose of the study was to obtain information on biological treatability of the benzene, phenol, phthalate, ketone organics and of the Superfund CERCLA organics bearing wastes in wastewater treatment systems which will support the development of an EPA technical guidance document on the discharge of the above organics to POTWs. The paper discusses the experimental design and procedural steps for the respirometric biodegradation and toxicity testing approach for individual organics or specific industrial wastes at different concentration levels in a mineral salts medium. A developed multi-level protocol is presented for determination of the biodegradability, microbial acclimation to toxic substrates and first order kinetic parameters of biodegradation for estimation of the Monod kinetic parameter of toxic organic compounds, in order to correlate the extent and rate of biodegradation with a predictive model based on chemical properties and molecular structure of these compounds. Respirometric biodegradation/inhibition and biokinetic data are provided for representative RCRA alkyl benzene and ketone organics.

53779 (PB–90-263229/XAB) **NATO/CCMS pilot study on demonstration of remedial-action technologies for contaminated land and ground water: 1988 activities.** Sanning, D.E.; Smith, M.A.; Bell, R.M. Environmental Protection Agency, Cincinnati, OH (USA). Risk Reduction Engineering Lab. ©1988. 12p. (EPA–600/D-90/135). Source: NTIS, PC A03/MF A01.

Pub. in Contaminated Soil '88, 1563-1572(1988).

The paper describes the nature, structure and content of the NATO Committee on the Challenges of Modern Society (CCMS) Pilot Study Demonstration of Remedial Action Technologies for Contaminated Land and Groundwater and the associated CCMS Fellowship program. To date, twelve projects in six countries have been selected for inclusion in the program which will involve periodic expert review during the five years for which the project will run. The paper draws special attention to the work on microbial clean up techniques included in the program, and the outcome of the first international meeting held in Washington, D.C. in 1987.

53780 (PB–90-263484/XAB) **Mercury levels in fish from the upper peninsula of Michigan (EIS Subregion 2B) in relation to lake acidity.** Landers, D.; Gloss, S.P.; Grieb, T.M.; Driscoll, C.T.; Schofield, C.L. Environmental Protection Agency, Corvallis, OR (USA). Environmental Research Lab. 1990. 116p. (EPA–600/3-90/068). Source: NTIS, PC A06/MF A01.

The accumulation of mercury by fish and the potential human health effects of eating mercury-contaminated fish have been well documented. However, elevated mercury concentrations in fish from dilute, low-pH lakes have only recently been associated with increased lake acidity. Nevertheless, there now is ample evidence to document that elevated levels of mercury are found in fish from lakes in remote areas with no known point sources of mercury and that an apparent relationship exists between lake pH and fish mercury level. The U.S. Food and Drug Administration (FDA) has set an action level of 1.0 ppm methyl mercury as the limit for human consumption. Many state fisheries agencies in the United States have established advisories regarding consumption of fish with mercury levels that do not exceed the standard of 1.0 ppm, usually invoking a standard of 0.5 ppm. Forty-nine drainage and seepage lakes in the Upper Michigan Peninsula were sampled in conjunction with Phase 2 of the U.S. Environmental Protection Agency's Eastern Lake Survey to explore the relationship between chemical and physical characteristics of lakes and mercury concentrations in fish tissue. The lakes were selected using a stratified random design weighted for low pH so that acidification effects on mercury accumulation could be evaluated. By coupling the study to Phase I, the authors were able to examine the role of chemical and physical lake variables on the assimilation of mercury by fish.

53781 (PB–90-264896/XAB) **Organic contaminants in sediments from the Trenton channel of the Detroit River, Michigan.** Furlong, E.T.; Carter, D.S.; Hites, R.A. Indiana Univ., Bloomington, IN (USA). ©1988. 14p. Grant EPA-R-813524. Source: NTIS, PC A03/MF A01.

Pub. in Jnl. of Great Lakes Research, Vol. 14, No. 4, 489-501(1988).

Anthropogenic organic contaminants in sediments from the Trenton Channel of the Detroit River, a highly industrialized waterway connecting Lake St. Clair with Lake Erie, were identified and quantified. The four major classes of organic contaminants identified were polycyclic aromatic hydrocarbons (PAH), polychlorinated biphenyls (PCB), polychlorinated naphthalenes (PCN), and polychlorinated terphenyls (PCT). Distributions of total PAH, the homologues of PCB and PCN, and total PCT were measured in 33 sediment samples. Concentration range maps revealed one region of relatively low contaminant concentration (southwest shore of Grosse Ile) and one area of high contaminant concentration in the vicinity of Monguagon Creek, located on the northwestern side of the Trenton Channel. Closer examination of total compound class and homologue concentration distributions suggests a hierarchical ordering of contaminant distribution similarity. Total PCT and PCN

concentration distributions are most similar to one another, suggesting a common source in the vicinity of the Monguagon Creek mouth. PAH and PCB distributions are less similar to each other and to total PCT and PCN distributions, suggesting different sources of these compound classes.

53782 (PB–90-264912/XAB) **Removing organic contaminants from ground water: A cost and performance evaluation.** Clark, R.M.; Fronk, C.A.; Lykins, B.W. Environmental Protection Agency, Cincinnati, OH (USA). Drinking Water Research Div. ©1988. 7p. (EPA–600/J-88/530). Source: NTIS, PC A02/MF A01.

Pub. in Environmental Science and Technology, Vol. 22, No. 10, 1126-1130(1988).

More than 100 million Americans depend on groundwater as a source of drinking water. Three quarters of U.S. cities get their water supplies totally or in part from groundwater and one-third of the largest cities rely on groundwater for at least part of their potable water supply. A number of recent studies have documented the actual or potential contamination of the nation's groundwater on a wide scale. Some of this contamination is man made but much of it is of natural origin. In either case some form of treatment is required before contaminated groundwater can be used for water supply. USEPA's Drinking Water Research Division has been conducting bench, pilot and field studies on technologies that effectively treat groundwater. The paper reports some of the results from these studies.

53783 (PB–90-265000/XAB) **Adsorption and desorption of Zn, Cu, and Cr by sediments from the Raisi River (Michigan).** Young, T.C.; DePinto, J.V.; Kipp, T.W. Clarkson Univ., Potsdam, NY (USA). Dept. of Civil and Environmental Engineering. ©1987. 16p. Grant EPA-810776. Source: NTIS, PC A03/MF A01.

Pub. in Jnl. Great Lakes Research, Vol. 13, No. 3, 353-366(1987).

Metal adsorption by Raisin River sediments in vitro depended linearly on soluble metal concentration to adsorption densities of 6,000-9,000 microg/g with 48 hr partition coefficients of approximately 50, 30, and 25 L/g for Cu, Cr, and Zn, respectively. Partition coefficients computed from field data spanned a comparatively wider range of values in a manner consistent with the often reported adsorbent concentration effect, but other factors likely contributed, too. Desorption of Zn was complete and rapid (24-48 hr) in contrast to Cr, which was incomplete and much slower; Cu desorption was intermediate to Zn and Cr. A reversible-resistant equilibrium model (DiToro et al. 1986) could not describe the observations as Cu and Cr had not reached metastable desorption equilibria after 24 days. Metal desorption, however, could be described kinetically by distributing sorbed cations between either of two classes; rapidly desorbing and slowly desorbing cations. Sequential and simultaneous desorption models gave similar predictions. Aqueous chemical considerations suggested precipitated as well as adsorbed species could give rise to the observations, but available data did not permit adequate tests of this hypothesis. The extent to which kinetic constraints rather than irreversible reactions account for the desorption-resistant binding signifies a potentially greater metal mobility or bioavailability than would otherwise be assumed.

53784 (PB–90-265034/XAB) **Partitioning of heavy metals to suspended solids of the Flint River, Michigan.** McIlroy, L.M.; DePinto, J.V.; Young, T.C.; Martin, S.C. Clarkson Univ., Potsdam, NY (USA). Dept. of Civil and Environmental Engineering. ©1986. 17p. Grant EPA-810776. Source: NTIS, PC A03/MF A01.

Pub. in Environmental Toxicology and Chemistry, Vol. 5, 609-623(1986).

The sorptive affinity of copper and zinc to suspended river sediments was investigated as a function of pH and adsorbent solids concentration. Water samples from the Flint River in Michigan were centrifuged to yield a composite sediment concentrate used as an adsorbent in experiments determining pH adsorption edges and conditional adsorption isotherms. Copper and zinc exhibited sharp pH adsorption edges at pH values of approximately 4 to 5.5 and 6 to 7, respectively. Both metals exhibited fractional adsorption decreases as total metal in the system increased. Adsorbent concentration increases were shown to cause decreases in measured copper partition coefficients. The indirect relationship between adsorbent concentration and partition coefficient was observed whether the adsorbent was concentrated or diluted without altering bulk solution chemistry. A mathematical formulation that incorporated both the adsorbent mass effects and the separation of sorbed metal into reversible and resistant components satisfactorily described the observations.

53785 (PB–90-265208/XAB) **Acidic deposition and aquatic ecosystems: Regional case studies. Final draft report.** Charles, D.F.; Christie, S. Indiana Univ., Bloomington, IN (USA). Aug 1990. 1413p. Source: NTIS, PC A99/MF E14.

The book is the first comprehensive, integrated synthesis of available information on the current and potential effects of acidic deposition on lakes and streams in geographic regions of the United States having significant numbers of low-alkalinity surface waters. It presents and evaluates data for entire regions and is national in scope. The authors have collected the results of diverse studies of aquatic ecosystems. The authors stress the current status of water chemistry and the processes important in controlling water chemistry. Authors of case study chapters have characterized these processes on a regional basis by using, assessing, and comparing high-quality data sets. A major conclusion demonstrated by these regional comparisons is that there is substantial diversity among regions with respect to the nature of surface waters and the processes affecting them. The most important contributions of the book are the descriptions of intra- and inter-regional variations in surface water chemistry and its controlling factors, and the assessment of the significance of these variations to our understanding of the acidic deposition phenomenon and its implications for public policy decisions.

53786 (PB–90-268517/XAB) **Superfund ground-water issue. Contaminant transport in fractured media: Models for decision makers.** Schmelling, S.G.; Ross, R.R. Environmental Protection Agency, Washington, DC (USA). Office of Emergency and Remedial Response. Aug 1989. 10p. (EPA–540/4-89/004). Source: NTIS, PC A02/MF A01.

The Regional Superfund Ground Water Forum is a group of ground-water technical specialists, representing EPA's Regional Superfund Offices, organized to exchange up-to-date information related to ground-water remediation at Superfund sites. Mathematical models have a potentially useful role to play in arriving at a decision on the remedial action to be taken at a contaminated site. Where there is a need for a quantitative estimate of the threat to public health resulting from a particular course of action, of the estimated cost and time of clean-up for a particular remediation strategy, or of the results of other actions to be taken at a contaminated site, mathematical models have a greater potential to provide the needed information than any other approach to the problem. For contaminated sites in fractured rock, however, this potential has yet to be realized.

53787 (WHC-EP–0142-4) **Ground water maps of Hanford Site Separations Areas, December 1989.** Kasza, G.L. Westinghouse Hanford Co., Richland, WA (USA). Jun 1990. 11p. Sponsored by U.S. DOE Office of Environmental Restoration and Waste Management. DOE Contract AC06-87RL10930. Order Number DE91001351. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The Separations Areas consist of the 200 East and 200 West areas and the surrounding vicinity on the Hanford Site. Chemical processing operations are carried out in the Separations Areas by Westinghouse Hanford Company for the US Department of Energy-Richland Operations Office. This set of ground water maps consists of: (1) Separations Areas depth-to-water map, (2) Separations Areas water table map, and (3) a map comparing the potentiometric surface of the Rattlesnake Ridge confined aquifer with the water table of the unconfined aquifer. The field measurements for these maps were collected during December 1989. 3 figs., 1 tab.

53788 (WSRC-MS–90-70) **Emergence of chironomidae in a newly impounded cooling reservoir.** Lauritsen, D. (Normandeau Associates, Inc., Aiken, SC (USA). Southeastern Regional Office). Westinghouse Savannah River Co., Aiken, SC (USA); Normandeau Associates, Inc., Aiken, SC (USA). Southeastern Regional Office.

[1990]. 15p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC09-89SR18035. (CONF-9005280--1: North American Benthological society conference, Blacksburg, VA (USA), 21-25 May 1990). Order Number DE91000783. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

L Lake, a once-through cooling reservoir on the Savannah River Plant in South Carolina, was created in late 1985. Biological sampling, initiated in January 1986, included monthly emergence trap sampling in littoral regions. Chironomids were the most abundant insects emerging from L Lake in the first three years of sampling (1986–1988). Glyptotendipes lobiferus dominated emergence in all three years, although its relative abundance declined substantially after the first year (mean emergence was 6.38/m^2/day in 1986, and declined to 1.79 /m^2/day in 1988). The relative importance of other littoral chironomid species changed over the three years–facultative chironomids were most abundant in the first year, while in 1987 and 1988, community composition began to shift towards species that are considered to be less characteristic of enriched habitats. This benthic community "succession" is probably in part due to the shift in the food base from decomposing organic material (after impoundment) to autochthonous production (with increasing reservoir age). 11 refs., 6 figs., 3 tabs.

55 BIOMEDICAL SCIENCES, BASIC STUDIES

5501 Behavioral Biology

53789 (CONF-901209–2) **Prediction of helicopter simulator sickness.** Horn, R.D. (Tennessee Univ., Knoxville, TN (USA). Dept. of Electrical and Computer Engineering); Birdwell, J.D.; Allgood, G.O. Oak Ridge National Lab., TN (USA). [1990]. 11p. Sponsored by U.S. DOE Energy Research; National Science Foundation. DOE Contract AC05-84OR21400. From 29. IEEE conference on decision and control; Honolulu, HI (USA); 5-7 Dec 1990. Order Number DE90016530. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Machine learning methods from artificial intelligence are used to identify information in sampled accelerometer signals and associative behavioral patterns which correlates pilot simulator sickness with helicopter simulator dynamics. These simulators are used to train pilots in fundamental procedures, tactics, and response to emergency conditions. Simulator sickness induced by these systems represents a risk factor to both the pilot and manufacturer. Simulator sickness symptoms are closely aligned with those of motion sickness. Previous studies have been performed by behavioral psychologists using information gathered with surveys and motor skills performance measures; however, the results are constrained by the limited information which is accessible in this manner. In this work, accelerometers were installed in the simulator cab, enabling a complete record of flight dynamics and the pilot's control response as a function of time. Given the results of performance measures administered to detect simulator sickness symptoms, the problem was then to find functions of the recorded data which could be used to help predict the simulator sickness level and susceptibility. Methods based upon inductive inference were used, which yield decision trees whose leaves indicate the degree of simulator-induced sickness. The long-term goal is to develop a "gauge" which can provide an on-line prediction of simulator sickness level, given a pilot's associative behavioral patterns (learned expectations). This will allow informed decisions to be made on when to terminate a hop and provide an effective basis for determining training and flight restrictions placed upon the pilot after simulator use. 6 refs., 6 figs.

5502 Biochemistry

Refer also to citation(s) 52919, 53369, 53375, 53387, 53806, 53864

53790 (AD-A–224444/0/XAB) **Specific radioisotopic assay for cholinesterase. Technical report, December 1987-March 1988.** Talbot, B.G.; Anderson, D.R.; Harris, L.W.; Lennox, W.J. Army Medical Research Inst. of Chemical Defense, Aberdeen Proving Ground, MD (USA). May 1990. 21p. (USAMRICD-TR–90-05). Source: NTIS, PC A03/MF A01.

The radiometric method (I) for measuring ChE activity was modified to preclude the use of p-dioxane, a hazardous material. The modified procedure (II) uses 0.4 N perchloric acid (PCA), instead of p-dioxane, to denature the ChE and stop hydrolysis of 14C-acetylcholine (ACh). The unreacted substrate (ACh) is removed by cationic exchange resin suspended in water. The supernatant (acidic water solution) containing the product of hydrolysis, 14C-acetic acid, is mixed with nonhazardous scintillation cocktail and counted. The incubation mixture (37 degrees C) for II is similar to I and is composed of 0.1 ml of buffer-salt solution (pH 7.8), 0.1 ml of guinea pig whole blood (WB)-water suspension and 0.1 ml of 3mM ACh solution.

53791 (DOE/ER/13709–4) **Phytochromes in photosynthetically competent plants: Progress report.** Pratt, L.H. Georgia Univ., Athens, GA (USA). Dept. of Botany. Jul 1990. 7p. Sponsored by U.S. DOE Energy Research. DOE Contract FG09-87ER13709. Order Number DE91000937. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Plants utilize light as a source of information in photomorphogenesis and of free energy in photosynthesis, two processes that are interrelated in that the former serves to increase the efficiency with which plants can perform the latter. Only one pigment involved in photomorphogenesis has been identified unequivocally, namely phytochrome. The thrust of this proposal is to investigate this pigment and its mode(s) of action in photosynthetically competent plants. Our long term objective is to characterize phytochrome and its functions in photosynthetically competent plants from molecular, biochemical and cellular perspectives. It is anticipated that others will continue to contribute indirectly to these efforts at the physiological level. The ultimate goal will be to develop this information from a comparative perspective in order to learn whether the different phytochromes have significantly different physicochemical properties, whether they fulfill independent functions and if so what these different functions are, and how each of the different phytochromes acts at primary molecular and cellular levels.

53792 (DOE/ER/60863–2) **Correlation of physical and genetic maps of human chromosome 16: Progress report, October 1, 1989–September 30, 1990.** Sutherland, G.R. Adelaide Children's Hospital, North Adelaide (Australia). 1990. 7p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-89ER60863. Order Number DE91000921. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

This project is now progressing strongly. Thirteen somatic cell hybrids containing rearranged #16 chromosomes have been constructed, bringing the total number of hybrids constructed by the group to 27 which divides chromosome 16 into 29 regions. 170 probes have been mapped into these regions. Although this is the second progress report for this contract it essentially contains all the work carried out since the first progress report covered a period of less than three months during which little had been done other than setting up. The project has been progressing very well and has led to numerous collaborations with other groups involved in mapping this chromosome or studying genes on it. 7 refs., 1 fig., 2 tabs.

53793 (DOE/ER/60875–1) **Production of radiolabeled monoclonal antibody conjugates by photoaffinity labeling: Performance report.** Volkert, W.A. (Missouri Univ., Columbia, MO (USA)); Ketring, A.R.; Kuntz, R.R.; Holmes, R.A.; Mitchell, E.P.; Feldbush, T.L. Missouri Univ., Columbia, MO (USA). Jun 1990. 9p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-89ER60875. Order Number DE91000827. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

This report discusses activities and progress that has occurred since initiation of this project on September 1, 1989. We have synthesized ethyl N,N'-bis(benzoylmercaptoacetyl)-2,3-diaminopropanoate, a ligand to be used as a bifunctional chelating agent (BFCA), to form ^{185}Re or ^{188}Re (^{186}Re/^{188}Re) complexes. ^{186}Re/^{188}Re, in reducing media, reacts with this ligand to form ^{186}Re/^{188}Re-CO_2DADS chelates that will be used to formulate new radiolabeled photoaffinity labels (RPALs). Initial steps have been taken to synthesize R-As-dithiol compounds. This approach will be

used to produce ^{77}As-RPALs or covalently link ^{77}As directly to monoclonal antibodies (MAbs). The R group will contain a group that can be used for conjugation reactions. Spectral and photochemical properties of various types of photoaffinity labels (PALs) have been studied. Acrylo-azido compounds and 9-azido acridine have been studied as well as several other photoprobes. The binding characteristics of the azido-based PALs to HSA have been studied and progress has been made on developing techniques for efficiently separating of non-covalently sound PALs. The Nd-YAG laser was purchased and arrived in 1990. It has been assembled and tested and is now operational.

53794 Triglyceride accumulation and fatty acid profile changes in Chlorella (Chlorophyta) during high pH-induced cell cycle inhibition. Guckert, J.B. (Montana State Univ., Bozeman (USA)); Cooksey, K.E. *Journal of Phycology (USA),* 26(1): 72-79 (Mar 1990).

Alkaline pH stress resulted in triglyceride (TG) accumulation in Chlorella CHLOR1 and was independent of medium nitrogen or carbon levels. Based on morphological observations, alkaline pH inhibited autospore release, thus increasing the time for cell cycle completion. Autospore release has been postulated to coincide with TG utilization within the microalgal cell division cycle. The alkaline pH stress affected lipid accumulation by inhibiting the cell division cycle prior to autospore release and, therefore, prior to TG utilization. Cells inhibited in this manner showed an increase in TG accumulation but a decrease in both membrane lipid classes (glycolipid and polar lipid). Unlike TG fatty acid profiles, membrane lipid fatty acid profiles were not stable during TG accumulation. The membrane profiles became similar to the TG, i.e. less unsaturated than in the membrane lipids of unstressed control cells.

53795 Cloning of the Zymomonas mobilis structural gene encoding alcohol dehydrogenase I (adhA): Sequence comparison and expression in Escherichia coli. Keshav, K.F. (Univ. of Florida, Gainesville (USA)); Yomano, L.P.; Haejung An; Ingram, L.O. *Journal of Bacteriology (USA),* 172(5): 2491-2497 (May 1990). DOE Contract FG05-86ER13575.

Zymomonas mobilis ferments sugars to produce ethanol with two biochemically distinct isoenzymes of alcohol dehydrogenase. The adhA gene encoding alcohol dehydrogenase I has now been sequenced and compared with the adhB gene, which encodes the second isoenzyme. The deduced amino acid sequences for these gene products exhibited no apparent homology. Alcohol dehydrogenase I contained 337 amino acids, with a subunit molecular weight of 36,096. Based on comparisons of primary amino acid sequences, this enzyme belongs to the family of zinc alcohol dehydrogenases which have been described primarily in eucaryotes. Nearly all of the 22 strictly conserved amino acids in this group were also conserved in Z. mobilis alcohol dehydrogenase I. Alcohol dehydrogenase I is an abundant protein, although adhA lacked many of the features previously reported in four other highly expressed genes from Z. mobilis. Codon usage in adhA is not highly biased and includes many codons which were unused by pdc, adhB, gap, and pgk. The ribosomal binding region of adhA lacked the canonical Shine-Dalgarno sequence found in the other highly expressed genes from Z. mobilis. Although these features may facilitate the expression of high enzyme levels, they do not appear to be essential for the expression of Z. mobilis adhA.

53796 The symbiotic defect of Rhizobium meliloti exopolysaccharide mutants is suppressed by lpsZ$^+$, a gene involved in lipopolysaccharide biosynthesis. Williams, M.N.V. (Massachusetts Institute of Technology, Cambridge (USA)); Klein, S.; Signer, E.R.; Hollingsworth, R.I. *Journal of Bacteriology (USA),* 172(5): 2622-2632 (May 1990).

exo mutants of Rhizobium meliloti SU47, which fail to secrete acidic extracellular polysaccharide (EPS), induce Fix$^-$ nodules on alfalfa. However, mutants of R. meliloti Rm41 carrying the same exo lesions induce normal Fix$^+$ nodules. The authors show that such induction is due to a gene from strain Rm41, which they call lpsZ$^+$, that is missing in strain SU47. lpsZ$^+$ does not restore EPS production but instead alters the composition an structure of lipopolysaccharide. In both SU47 and Rm41, either lpsZ$^+$ or exo$^+$ is sufficient for normal nodulation. This suggests that in R. meliloti EPS and lipopolysaccharide can perform the same function in nodule development.

53797 Mutagenesis of dimeric plasmids by the transposon $\gamma\delta$ (Tn1000). Liu, L. (Univ. of Connecticut, Storrs (USA)); Berg, C.M. *Journal of Bacteriology (USA),* 172(5): 2814-2816 (May 1990). DOE Contract FG02-89ER60862.

The Escherichia coli F factor mediates conjugal transfer of a plasmid such as pBR322 primarily by replicative transposition of transposon $\gamma\delta$ (Tn1000) from F to that plasmid to form a cointegrate intermediate. Although resolution of this cointegrate always yields a plasmid containing a single $\gamma\delta$ insertion, the occasional recovery of transposon-free plasmids after connuugal transfer has led to alternative hypotheses for F mobilization. The authors show here that $\gamma\delta$-free plasmids are found after F-mediated conjugal transfer only when the donor plasmid is a dimer and the recipient is Rec$^+$.

53798 Identification and characterization of hetA, a gene that acts early in the process of morphological differentiation of heterocysts. Holland, D. (Michigan State Univ., East Lansing (USA)); Wolk, C.P. *Journal of Bacteriology (USA),* 172(6): 3131-3137 (Jun 1990). DOE Contract AC02-76ER01338.

Envelope polysaccharide is a major early diagnostic of differentiating heterocysts. The mutation in mutant EF116 of Anabaena sp. strain PCC 7120 reduces the cohesiveness of this polysaccharide. A 3.5-kilobase fragment of DNA cloned from the wild type of this Anabaena sp. was previously shown to complement this mutation. The authors present the nucleotide sequence of a 2,555-base-pair portion of this fragment containing an open reading frame (ORF) of 601 amino acids. Complementation analysis using deletion derives of the 3.5-kilobase fragment showed that the gene mutated in EF116, which they designate hetA, lies within this ORF. Transcription of hetA was induced as a result of deprivation for nitrate and yielded a monocistronic mRNA that was present at greatest abundance 7 h after nitrogen stepdown. At that time, proheterocysts could not be distinguished by light microscopy; transcription of nifHD, structural genes of nitrogenase, peaked much later. Situated 3′ to hetA are 4 identical repeats of the sequence 5′-TTCAAAA-3′ and 12 repeats (10 identical) of the sequence 5′-CCCCAAT-3′. The 12 repeats, present within and near the 5′ end of a second ORF, are almost identical to repeats that have been reported to be present in the region between the petC and petA genes of a related cyanobacterium.

53799 Use of a conditionally lethal gene in Anabaena sp. strain PCC 7120 to select for double recombinants and to entrap insertion sequences. Cai, Yuping (Michigan State Univ., East Lansing (USA)); Wolk, C.P. *Journal of Bacteriology (USA),* 172(6): 3138-3145 (Jun 1990). DOE Contract AC02-76ER01338.

Use of the sacB gene provides a simple, effective, positive selection for double recombinants in Anabaena sp. strain PCC 7120, a filamentous cyanobacterium. This gene, which encodes the secretory levansucrase of Bacillus subtilis, was inserted into the vector portion of a suicide plasmid bearing a mutant version of a chromosomal gene. Cells of colonies in which such a plasmid had integrated into the Anabaena chromosome through single recombination were plated on solid medium containing 5% sucrose. Under this condition, the presence of the sacB gene is lethal. A small fraction of the cells from initially sucrose-sensitive colonies became sucrose resistant; the majority of these sucrose-resistant derivatives had undergone a second recombinational event in which the sacB-containing vector had been lost and the wild-type form of the chromosomal gene had been replaced by the mutant form. By the use of this technique, they mutated two selected genes in the chromosome of Anabaena sp. strain PCC 7120. The conditionally lethal nature of the sacB gene was also used to detect insertion sequences from this Anabaena strain. Sucrose-resistant colonies derived from cells bearing a sacB-containing autonomously replicating plasmid were analyzed. Five different, presumed insertion sequences were found to have inserted into the sacB gene of the plasmids in these colonies. One of them, denoted IS892, was characterized by physical mapping. It is 1.7 kilobases in size and is present in at least five copies in the genome of Anabaena sp. strain PCC 7120.

53800 Highly virulent strains of Pseudomonas solanacearum that are defective in extracellular-polysaccharide production. Xu, Peilin (Dept. of Agriculture (USA)); Iwata, Michiaki; Sequeira, L.; Leong, S. *Journal of Bacteriology (USA)*, 172(7): 3946-3951 (Jul 1990). DOE Contract FG09-87ER13810.

Extracellular polysaccharide (EPS) has long been regarded as one of the mos important factors involved in wilting of plants by Pseudomonas solanacearum. By means of transposon Tn5 mutagensis, the authors have isolated a class of mutants that have an afluidal colony morphology but retain the ability to cause severe wilting and death of tobacco plants. One such mutant, KD700, was studied in detail. By marker exchange mutagenesis, the altered colony morphology was shown to be the result of a single Tn5 insertion in a 14.3-kilobase EcoRI fragment. This defect could be corrected by introducing a homologous clone from a cosmid library of the wild-type, parental strain K60. The Tn5-containing fragment was introduced into other P. solanacearum wild-type strains by marker exchange, and these altered strains had the same afluidal phenotype as KD700. N-Acetylgalactosamine (GalNac), the major constituent of EPS of all wild-type strains of P. solanacearum, was not detected by gas chromatography-mass spectrometry analysis of vascular fluids from wilting plants infected by KD700. In contrast, GalNac was readily detected in similar fluids of plants infected by K60. Polysaccharides extracted from culture filtrates of KD700 contained approximately one-fifth of the GalNac present in polysaccharides from K60. No differences in growth rates in culture or in planta between the mutant and the parental strains were observed. Since strains that are deficient in EPS production can remain highly virulent to tobacco, they conclude that EPS, or at least its GalNac-containing component, may not be required for disease development by P. solanacearum.

53801 Cellulase system of a free-living, mesophilic Clostridium (strain C7). Cavedon, K. (Univ. of Massachusetts, Amherst (USA)); Leschine, S.B.; Canale-Parola, E. *Journal of Bacteriology (USA)*, 172(8): 4222-4230 (Aug 1990). DOE Contract FG02-88ER13898 ;AC02-81ER10878.

The enzymatic activity responsible for crystalline cellulose degradation (Avicelase activity) by a mesophilic clostridium (strain C7) was present in culture supernatant fluid but was not detected in significant amounts in association with whole cells or in disrupted cells. Cells of the mesophilic clostridium lacked cellulosome clusters on their surface and did not adhere to cellulose fibers. The results of the study indicated that an extracellular 700,000-M_r multiprotein complex, consisting of at least 15 proteins, is utilized by the mesophilic clostridium for the hydrolysis of crystalline cellulose. At least six different endo-1,4-β-glucanases may be part of the cellulase system of strain C7. Sephacryl S-300 column fractions, corresponding to an A_{280} peak in the 130,000-M_r region, contained carboxymethylcellulase-active proteins that may serve as precursors for the assembly of the Avicelase-active complex by the mesophilic clostridium.

53802 Gene encoding the 5.7-kilodalton chlorosome protein of Chloroflexus aurantiacus: Regulated message levels and a predicted carboxy-terminal protein extension. Theroux, S.J. (Univ. of Massachusetts, Amherst (USA)); Redlinger, T.E.; Fuller, R.C.; Robinson, S.J. *Journal of Bacteriology (USA)*, 172(8): 4497-4504 (Aug 1990). DOE Contract FG02-88ER13921.

The major light-harvesting pigment of the green filamentous bacterium Chloroflexus aurantiacus is bacteriochlorophyll (Bchl) c, localized in chlorosomes attached to the inner surface of the cytoplasmic membrane. Chlorosomes consist of four polypeptides and associated pigments and lipids. Previous studies of the inducible assembly of the photosynthetic apparatus had indicated that the major chlorosomal polypeptides are present as high-molecular-weight aggregates before the appearance of mature chlorosomes, and a mechanism for posttranslational processing of a polyprotein had been proposed. The authors have isolated the gene (csmA) encoding the 5.7-kilodalton chlorosomal polypeptide from C. aurantiacus in order to determine whether this protein is synthesized as part of a polyprotein. Analysis of the nucleotide sequence of csmA indicates that the gene is not large enough to encode more than one known chlorosome polypeptide. Transcriptional analysis indicates that csmA is transcribed as a small message whose abundance is regulated in response to oxygen, so that no csmA message is detectable in cells grown aerobically in the dark. Comparison of the sequence predicted by csmA with the peptide sequence of the Bchl c binding protein purified for chlorosomes indicates that this protein is synthesized with a carboxy-terminal extension of 27 amino acids. They discuss possible roles for this carboxy-terminal extension in the assembly of chlorosomes.

5503 Cytology

Refer also to citation(s) 53835

53803 (CONF-9008158–1) **Critical tonicity determination of sperm using fluorescent staining and flow cytometry.** Noiles, E.E. (Methodist Hospital, Indianapolis, IN (USA)); Ruffing, N.A.; Kleinhans, F.W.; Mark, L.A.; Watson, P.F.; Critser, J.K.; Horstman, L.; Mazur, P. Oak Ridge National Lab., TN (USA). [1990]. 6p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From 2. international conference on the preservation of boar semen; Beltsville, MD (USA); 19-22 Aug 1990. Order Number DE91000617. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The use of cryopreserved, rather than fresh, mammalian semen for artificial insemination confers several important medical and/or economic advantages. However, current methods for cryopreservation of both human and bovine spermatozoa result in approximately only a 50% survival rate with thawing, obviously reducing the fertilizing capacity of the semen. A primary consideration during the cooling process is to avoid intracellular ice crystal formation with its lethal consequences to the cell. Current techniques achieve this by controlling the cooling rate. Computation of the time necessary for this dehydration, and hence, the cooling rate, is dependent upon knowledge of the water permeability coefficient (L_p) and its activation energy. The fluorophore, 6-carboxyfluoroscein diacetate (CFDA), which is nonfluorescent, readily crosses the intact plasma membrane. Intracellular esterases hydrolyze CFDA to 6-carboxyfluoroscein, a fluorescent, membrane-impermeable fluorophore. Consequently, spermatozoa with intact plasma membranes fluoresce bright green (Garner et. al., 1986), but those with disrupted membranes do not. Therefore, the purpose of this study was to use loss of CFDA fluorescence to determine the osmolality at which 50% of the spermatozoa will swell and lyse (critical tonicity, CT). These data will then be used to determine the L_p and its activation energy for sperm, thus increasing the knowledge available in cellular cryopreservation. 15 refs., 3 figs.

5504 Genetics

Refer also to citation(s) 52911, 52915, 53792, 53799, 53837, 53839

53804 (CONF-9007175–1) **Deceptiveness and genetic algorithm dynamics.** Liepins, G.E. (Oak Ridge National Lab., TN (USA)); Vose, M.D. Oak Ridge National Lab., TN (USA); Tennessee Univ., Knoxville, TN (USA). [1990]. 13p. Sponsored by U.S. DOE Energy Research; National Science Foundation. DOE Contract AC05-84OR21400. Grant IRI-8917545. From Genetic algorithms theory workshop; Bloomington, IN (USA); 16-18 Jul 1990. Order Number DE91000723. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

We address deceptiveness, one of at least four reasons genetic algorithms can fail to converge to function optima. We construct fully deceptive functions and other functions of intermediate deceptiveness. For the fully deceptive functions of our construction, we generate linear transformations that induce changes of representation to render the functions fully easy. We further model genetic algorithm selection recombination as the interleaving of linear and quadratic operators. Spectral analysis of the underlying matrices allows us to draw preliminary conclusions about fixed points and their stability. We also obtain an explicit formula relating the nonuniform Walsh transform to the dynamics of genetic search. 21 refs.

53805 Integration of bacteriophage λ into the cryptic lambdoid propheges of Escherichia coli. Lichens-Park, A. (Harvard Medical School, Boston, MA (USA)); Smith, C.L.; Syvanen, M. *Journal of Bacteriology (USA)*, 172(5): 2201-2208 (May 1990).

Bacteriophage lambda missing its chromosomal attachment site will integrate into recA+ Escherichia coli K-12 and C at the site of cryptic prophages. The specific regions in which these recombination events occur were identified in both lambda and the bacterial chromosomes. A NotI restriction site on the prophage allowed its physical mapping. This allowed them to identify the locations of Rac, Qin, and Qsr' cryptic prophages on the NotI map of E. coli K-12 and, by analogy, to identify the cryptic prophage in E. coli C as Qin. No new cryptic prophages were detected in E. coli K-12.

5505 Metabolism

Refer also to citation(s) 52908, 53855

5506 Medicine

Refer also to citation(s) 53398, 53833

53806 (DOE/ER/60649–A3) **Development of gamma-emitting, receptor binding radiotracers for imaging the brain and pancreas: Progress report, November 1, 1989–August 31, 1990.** Reba, R.C. George Washington Univ., Washington, DC (USA). Div. of Nuclear Medicine. [1990]. 9p. Sponsored by U.S. DOE Energy Research. DOE Contract FG05-88ER60649. Order Number DE91000676. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

This progress report covers period from Nov. 1, 1989 to Aug. 31, 1990. The long term objective was to develop receptor-binding radiotracers for SPECT or PET imaging of CNS or peripheral nervous system. The specific chemistry aims, as understood on the basis of past findings, were: to synthesize and develop a more polar analogs of 4IQNB, possessing similar binding characteristics but eliminated more rapidly from the surrounding tissues and the target organ, to design a method of introducing a technetium chelating group onto a molecule or cholinergic agent without drastic lowering of its apparent affinity, to synthesize and develop radiotracers based on m-AChR antagonists selective for one of the subtypes of the receptor. The chemistry service aims were to prepare and characterize (R,R)- and (R,S)-4IQNB and derivatives, to provide the triazene intermediate to other investigators, and to provide [^{123}I]4IQNB for in vivo imaging. The biochemistry aims were to characterize the vitro and in vivo properties of novel compounds and to perform the pharmacokinetic studies. 3 refs., 5 tabs.

53807 (ULI-RAD-R–059) **Grids in mammography: Optimization of the information content relative to radiation risk.** Alm Carlsson, G.; Dance, D.R.; Persliden, J. Linkoeping Univ. (Sweden). Dept. of Radiation Physics. 31 Aug 1989. 63p. Order Number DE91605855. Source: NTIS (US Sales Only), PC A04/MF A01; OSTI; INIS.

The use of grids in mammography screening has been an issue of debate in recent years. Based upon the experience of a pilot study of mammography screening in Sweden, the Swedish National Institute of Radiation Protection concluded that screening could be successfully performed without having to increase the mean absorbed dose in a standard breast above 1 mGy. Due to the Institute's limit for the mean absorbed dose, 'not essentially exceeding 1 mGy', the use of grids was effectively ruled out. Experience, however, has indicated that the improved image quality using a grid would reduce the number of healthy women which are called to complementary examinations. Therefore, the use of grids in screening procedures is being reconsidered. The aim of this work was to elucidate the problem by investigating the influence of grid construction on image contrast and breast mean absorbed dose by means of Monte Carlo techniques to simulate the photon transport in the breast.

53808 **Evaluation and treatment of persons exposed to internally deposited radionuclides.** Volez, G.L. (Occupational Medicine Group, Los Alamos National Lab., Los Alamos, NM (US)). pp. 151-168 of Medical management of radiation accidents. Mettler, F.A. Jr.; Kelsey, C.A.; Ricks, R.C. CRC Press Inc., Boca Raton, FL (USA) (1990). pp. 396

This chapter focuses on the evaluation and treatment of internally deposited radionuclides form a clinical standpoint. Background information to assist physicians in the medical management of these cases is provided.

5507 Microbiology

Refer also to citation(s) 52913, 53164, 53843

5509 Pathology

Refer also to citation(s) 53844

5530 Agriculture and Food Technology

Refer also to citation(s) 53359

53809 (AD-A–224288/1/XAB) **Differences in susceptibility among mouse strains to infection with Plasmodium berghei (ANKA clone) sporozoites and its relationship to protection by gamma-irradiated sporozoites.** Jaffe, R.I.; Lowell, G.H.; Gordon, D.M. Walter Reed Army Inst. of Research, Washington, DC (USA). Div. of Communicable Disease and Immunology. 1990. 6p. Source: NTIS, PC A02/MF A01.

Pub. in American Jnl. of Tropical Medical Hygiene, Vol. 42, No. 4, 309-313(1990).

Three inbred mouse strains, C57BL/6 (H-2/b/), A/J (H-2/a/), and BALB/C (H-2/d/), and one outbred strain, CD-1, demonstrated differences in susceptibility to challenge intravenously with the ANKA clone of Plasmodium berghei. Mice were challenged with 100, 1000, or 10000 sporozoites, then evaluated daily beginning on day 4 for patency. CD-1 mice were further evaluated at challenge doses of 125000, 25000, and 50000 sporozoites. C57BL/6 mice were the easiest to infect with 90% becoming infected with 100 sporozoites. The outbred strain CD-1 was the most difficult to infect requiring a challenge dose of 25000 sporozoites per mouse in order to achieve a 100% infection rate. Mouse strains also demonstrated differences in their ability to be protected by intravenous immunization with gamma-irradiated sporozoites. A/J mice needed a minimum of 3 doses of irradiated sporozoites for protection against a challenge with 1000 sporozoites. In contrast BALB/C mice, immunized with a single dose of 1000 irradiated sporozoites, are protected against a 10000 sporozoite challenge. These data suggest that both infectivity and protection are genetically restricted and that susceptibility to infection may be inversely related to protection.

53810 (CONF-9008158–2) **ESR [electron spin resonance]-determined osmotic behavior of bull spermatozoa.** Du, J. (Methodist Hospital, Indianapolis, IN (USA). Dept. of Medical Research); Kleinhans, F.W.; Spitzer, V.J.; Critser, J.K.; Horstman, L.; Mazur, P. Oak Ridge National Lab., TN (USA). [1990]. 4p. Sponsored by U.S. Department of Agriculture; U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Grant 89-37240-4681. From 2. international conference on the preservation of boar semen; Beltsville, MD (USA); 19-22 Aug 1990. Order Number DE91000728. Source: NTIS, PC A01/MF A01 - OSTI; GPO Dep.

Our laboratories are pursuing a fundamental approach to the problems of semen cryopreservation. For many cell types (human red cells, yeast, HeLa) it has been demonstrated that there is an optimum cooling rate for cryopreservation. Faster rates allow insufficient time for cell dehydration and result in intracellular ice formation and cell death. It is possible to predict this optimal rate provided that the cell acts as an ideal osmometer and several other cell parameters are known such as the membrane hydraulic conductivity. It is the purpose of this work to examine the osmotic response of bull sperm to sucrose and NaCl utilizing electron spin resonance (ESR) to measure cell volume. For calibration purposes we also measured the ESR response of human red cells (RBC), the osmotic response of which is well documented with other methods. 15 refs., 1 fig.

56 BIOMEDICAL SCIENCES, APPLIED STUDIES

5601 Radiation Effects

Refer also to citation(s) 53084, 53646, 53654, 53664, 53808, 53861, 54181

53811 (AD-A-224030/7/XAB) **Alterations in rat cardiac myosin isozymes induced by whole-body irradiation are prevented by 3,5,3′-l-triiodothyronine.** Litten, R.Z.; Fein, H.G.; Gainey, G.T.; Walden, T.L.; Smallridge, R.C. Walter Reed Army Inst. of Research, Washington, DC (USA). Jan 1990. 6p. Source: NTIS, PC A02/MF A01.

Pub. in Metabolism, Vol. 39, No. 1, 64-68(Jan 1990).

Three types of cardiac myosin isozymes have been shown to exist within the ventricle of the heart: V1, V2, and V3. V1 contains two alpha-heavy chains, whereas V3 consist of two beta chains. V2, which is a minor component, is a heterodimer composed of one alpha- and one beta-heavy chain. The relative proportions of the cardiac myosin isozymes change under various conditions. There is a shift toward V3 isozyme with an increase in age as well as cardiac hypertrophy induced by pressure overload.

53812 (AD-A-224337/6/XAB) **Long-term mortality and cancer risk in irradiated rhesus monkeys. Interim report, 30 September 1983-15 July 1989.** Wood, D.H. School of Aerospace Medicine, Brooks AFB, TX (USA). May 1990. 37p. (USAFSAM-JA-90-36). Source: NTIS, PC A03/MF A01.

Lifetime observations on a group of 358 rhesus monkeys indicate that life expectancy loss from exposure to protons in the energy range encountered in the Van Allen belts and solar proton events is influenced primarily by the dose rather than the energy of radiation. After 24 years, life expectancy losses from similar surface doses of low-LET (136-2300 MeV) and high-LET (32-55 MeV) protons are not significantly different, but the high-LET protons are associated with more deaths in the early years, while the low-LET protons contribute more to mortality in later years. In males, the most significant cause of life shortening is nonleukemia cancers.

53813 (AD-A-224365/7/XAB) **Long-term mortality and cancer risk in irradiated rhesus monkeys.** Wood, D.H. School of Aerospace Medicine, Brooks AFB, TX (USA). 1989. 36p. Source: NTIS, PC A03/MF A01.

Lifetime observations on a group of 358 rhesus monkeys indicate that life expectancy loss from exposure to protons in the energy range encountered in the Van Allen belts and solar proton events is influenced primarily by the dose rather than by the energy of radiation. After 24 years, life expectancy losses from similar surface doses of low-LET (138-2300 MeV) and high-LET (32-55 MeV) protons are not significantly different, but the high-LET protons are associated with more deaths in the early years, while the low-LET protons contribute more to mortality in later years. In males, the most significant cause of life shortening is nonleukemia cancers. In females, radiation increased the risk of endometriosis (an abnormal proliferation of the lining of the uterus) which resulted in significant mortality in the years before early detection and treatment methods were employed. The findings support the 1989 guidelines of the NCRP for maximum permissible radiation exposures in astronauts.

53814 (BfS-ISH-140/89) **Collection, documentation and assessment of data measured in the Federal Republic of Germany after the reactor accident in the nuclear power plant at Chernobyl.** Bayer, A.; Braun, H.; Dehos, R.; Frasch, G.; Haubelt, R.; Hoppe-Schoenhammer, J.; Kaul, A.; Loebke, A.; Werner, M. Bundesamt fuer Strahlenschutz, Neuherberg (Germany, F.R.). Inst. fuer Strahlenhygiene. Aug 1989. 184p. (In German). Order Number DE91717058. Source: NTIS (US Sales Only), PC A09/MF A01.

Representative for the Federal Republic of Germany, regions were selected that showed a lesser (Hesse) and higher (Bavaria) contamination. The contamination in individual environmental media (milk, i.a.) was demonstrated by values measured and assessed on a prognostic model and subsequently compared with each other. The intake was then evaluated on the basis of food basket and total body measurement data for determining the dose for various age groups and regions. Against those from food baskets, the doses derived from total body measurements were generally lower by 20-60%. This indicates change in consumption habits, adherence to recommendations and the effect of countermeasures, particularly in the higher contaminated southern region of the Federal Republic of Germany. The intake and dose assessments were compared to those measured during the time of contamination from fallout due to nuclear weapons tests. External radiation exposure and cumulative dose from fallout due to nuclear weapons tests and the Chernobyl accident were calculated. In 1986, the radiation exposure from external sources and from ingestion in consequence of the reactor accident had reached in the region of highest contamination (County of Berchtesgaden) 40%, in the lesser contaminated region (Hesse) about 5% of the average natural radiation exposure. (orig./HP).

53815 (CNIC-00307) **The changes of production of lymphokines from gamma irradiated human tonsillar lymphocytes: Pt. 2: Natural killer cytotoxic factor (NKCF).** Miao Jingcheng (Suzhou Medical Coll., JS (China)); Zhang Lansheng. China Nuclear Information Centre, Beijing, BJ (China). Feb 1989. 6p. (In Chinese). (SMC-0032). Order Number DE91605740. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

The human tonsillar lymphocytes were exposed to gamma rays in various doses (0 ≈ 40 Gy) and stimulated by PHA, then cultured for 24 to 96 hours. The activities of NKCF in the supernatants were assayed by MTT colorimetric method. The results showed: (1) The activity of NKCF was slightly inhibited by irradiation of 2.5 ≈ 40 Gy; (2) The activity of NKCF in the supernatants cultured for 48 to 96 hours is obviously higher than that for 24 hours. Both the irradiation doses and cultural periods had no interactiion on the changes of the production of NKCF. The radiation resistance of NK cells in the experiment is similar to other results. The tonsillar Nk cells activated in the state of chronic inflamation has higher radioresistance.

53816 (CNIC-00314) **The effects of ^{60}Co γ-ray irradiation on cytoplasmic microtubules of mouse macrophages and lymphocytes.** Li Qianqian (Suzhou Medical Coll., JS (China)); Mao Zijun; Yin Zhiwei; Hu Yumin. China Nuclear Information Centre, Beijing, BJ (China). May 1989. 9p. (In Chinese). (SMC-0033). Order Number DE91605741. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

The effects of ^{60}Co γ-ray irradiation on cytoplasmic microtubules of mouse macrophages and lymphocytes were investigated by immunofluorescence microscopy and scanning electron microscope. The results indicated. (1) microtubule organization of the irradiated cells remarkably differed from that of the control since the doses over 4 Gy; (2) 144 hours after irradiation the alterations of microtubules have been shown to be basically 'epaired' (3) the cytoplasmic microtubules and centrioles disappeared under transmission electron microscope, the membranes irradiated and microvilli showed changes under scanning electron microscope too. From these observations and those of other workers who studied the radiation effect on extracted microtubule proteins in vitro, the authors support that ^{60}Co γ-ray irradiation can inhabits cytoplasmic microtubule assembling.

53817 (CNIC-00318) **Selected compilation of clinical cases for over exposure workers of the Chinese nuclear industry in the past 30 years.** Ma Ruwei (China National Nuclear Corporation, Beijing, BJ (China). Protection Environment and Health); Bai Guang; Sun Shize (eds.). China Nuclear Information Centre, Beijing, BJ (China). May 1989. 26p. (DSPHN-0003). Order Number DE91605772. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

The paper is reviewed by Pan Ziqiang and Li Zhenping.

This report is a professional reference book on clinical medical management of overexposed individuals. It collects the medical records of the cases accumulated in the past 30 years in nuclear industry including patients with internal contamination of radionuclide, with overexposed intake of natural uranium, with radiation skin injury and overdose external exposure. The report describes the clinical practical experience in prevention and treatment of internal contamination radiation injury, radiation skin injury, as well as radiation effect of overdose external exposure in the nuclear industry.

53818 (CNIC–00379) **Comparative study of accumulation of different radiators in germ cells on induction of radiogenotoxicological effect.** Zhu Shoupeng (Suzhou Medical Coll., JS (China)); Zheng Siying; Wang Liuyi; Yang Weidong. China Nuclear Information Centre, Beijing, BJ (China). 1989. 8p. (In Chinese). (SMC–0042). Order Number DE91605787. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

The purpose of the present study is to ascertain comparative retention of ^{147}Pm or ^{134}Cs in germ cells on induction of chromosome aberrations of spermatogonium and abnormalities in sperm. Results indicated that after iv ^{147}Pm through 50d observation. The retention data in testis were well described by an exponential expression: $R(t) = 0.1872 \times e^{-0.0066t}$, where the retention $T_{1/2} = 105$ d. While the retention data of ^{134}Cs in testis were described by an expression: $R(t) = 0.0045 \times e^{-0.133t}$, where the retention $T_{1/2}$ was only 5.2d. Experiments indicated that the retention value and the absorption dose of ^{147}Pm in testis were significantly high in comparison with ^{134}Cs. Internal contamination of ^{147}Pm or ^{134}Cs can induce chromosome aberrations in germ cells and abnormalities in sperm. Among the types of chromosome aberrations of spermatogonium induced by ^{147}Pm or ^{134}Cs include gap, chromatid breakage, chromosome breakage, and translocation, as well as polyploid cells were elevated when the periods of contamination of ^{147}Pm were prolonged. At the same time chromosome fragment and translocations of primary spermatocyte also induced by ^{147}Pm. Studies showed that polyvalent of primary spermatocyte were enlarged only through 10 days of ^{147}Pm contamination. Abnormalities in sperm induced by ^{147}Pm or ^{134}Cs-non-hock sperms were predominant. By comparison with, however, the induction of cytogenetic effects on germ cells by ^{134}Cs was quite low.

53819 (HSE-Trans–13516B) **Examination of respiratory tract in workers occupationally exposed to beryllium.** Cianciara, M. (Research and Production Centre for Semiconductive Materials, Warsaw (Poland). Preventive-Medical Dept.); Swiatkowski, J. Health and Safety Executive, London (UK). [1989]. 11p. Translated from Medycyna Pracy (1978) v. 34(2) p. 153-161. Source: Available from The British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

Translated from Medycyna Pracy (1978) v. 34(2) p. 153-161.

In a group (30) occupationally exposed to beryllium below the Maximum Allowed Concentration, deviations from the norm were found in 13% of chest x rays and impairments of lung ventilatory reserves in 46%. The low intensity and non-specific character of the changes did not allow confirmation of connection with occupational exposure. Radiological examination of the lungs, expanded functional testing of the respiratory system and measurements of blood gases are recommended to identify workers with respiratory changes at an early stage. (UK).

53820 (HSE-Trans–13517A) **An evaluation of delayed-type immune response using specific skin test with beryllium chloride and beryllium sulphate in workers exposed to beryllium and its compounds.** Cianciara, M. (Centre for Research and Production of Semiconductive Materials, Warsaw (Poland). Preventive-Medical Dept.). Health and Safety Executive, London (UK). [1989]. 6p. Translated from Polski Tygodnik Lekarski (1976) v. 31(8) p. 305-307. Source: Available from The British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

Translated from Polski Tygodnik Lekarski (1976) v. 31(8) p. 305-307.

In a number of persons (26.6% of a 30 member group) exposed to beryllium, there appear positive reactions in the skin tests with beryllium sulphate and beryllium chloride, characteristic for the immunological response of the delayed type. The likelihood of positive skin reactions increases with the duration of exposure to beryllium at work. Specific skin test is of value in evaluating individual immunological reactivity. Both compounds, beryllium sulphate and beryllium chloride, give similar results and can be used in specific skin tests. (author).

53821 (HSE-Trans–13521A) **Changes in the antigenic composition in the lungs in experimental beryllosis.** Vasil'eva, E.V. (USSR Academy of Medical Sciences, Moscow (USSR). Inst. of Industrial Hygiene and Occupational Diseases). Health and Safety Executive, London (UK). Nov 1989. 7p. Translated from Byull. Ehksp. Biol. Med. (1972) v. 13(2) p. 76-80. Source: Available from The British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

Translated from Byull. Ehksp. Biol. Med. (1972) v. 13(2) p. 76-80.

In the nucleoprotein fraction of the lungs of August rats with experimental berylliosis six new antigens were revealed with the aid of immunoelectrophoresis. Their electrophoretic mobility was compared to that of human serum albumin. By means of active anaphylaxis and Zilber's method it is shown that a part of additional antigens, apparently, contains beryllium in the antigenic group, whereas in other antigens it is absent. (author).

53822 (HSE-Trans–13541A) **Intoxication experiments with beryllium sulphate.** Bucurescu, I.; Stan, T. Health and Safety Executive, London (UK). Jan 1990. 10p. Translated from Farmacia (1973) v. 21(11) p. 699-704. Source: Available from The British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

Translated from Farmacia (1973) v. 21(11) p. 699-704.

The changes in the particular number of animals in two groups of 40 rats each subjected to intoxication experiments with beryllium sulphate was investigated. The two investigations had very different characteristics. In the case of chronic intoxication there was a marked lethality over given time intervals. In the case of subacute intoxication the number of animals decreased with time. It was found empirically that this change can be described by an exponential relationship which lends itself to statistical interpretation. (author).

53823 (HSE-Trans–13545A) **The kinetics of metabolism, distribution and excretion of beryllium from the body.** Zhuravlev, V.F.; Bugryshev, P.F. Health and Safety Executive, London (UK). Dec 1989. 6p. Translated from Gigiena i Sanitariya v. 39 p. 74-77. Source: Available from The British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

Translated from Gigiena i Sanitariya v. 39 p. 74-77.

The results obtained show that the level and dynamics of excretion of beryllium from the body of animals depend on the physical and chemical state of the introduced compound and on the route by which it entered the body. Although it has been established that most of the beryllium is excreted in urine soon after it entered the body the methods of excretion differ. (author).

53824 (HSE-Trans–13546A) **Blastomogenic activities of various beryllium compounds.** Litvinov, N.N. (Ministry of Public Health, Moscow (USSR). Inst. of Biophysics); Kazenashev, V.F.; Bugryshev, P.F. Health and Safety Executive, London (UK). Dec 1989. 6p. Translated from Eksperimentalnaya onkologiya (1983) v. 5(4) p. 23-26. Source: Available from The British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

Translated from Eksperimentalnaya onkologiya (1983) v. 5(4) p. 23-26.

Experiments with albino mongrel rats have shown that metallic beryllium, beryllium oxides roasted at different temperatures, beryllium fluoride and beryllium chloride induce lung cancer under conditions of single intratracheal, single and chronic inhalation. The results of the authors' experiments agree with published epidemiological data concerning a higher cancer risk among workers subjected to long- and short-term professional exposure to beryllium compounds. (author).

53825 (HSE-Trans–13559D) **Immunological properties of silica and beryllium compounds: a comparison of soluble and insoluble forms.** Voisin, G.A. (Saint-Antoine Hospital, Paris (France). Immunopathology Centre of the Claude Bernard Association); Collet, A.; Martin, J.C.; Daniel-Moussard, H.; Toullet, F. Health and Safety Executive, London (UK). Jan 1990. 26p. Translated from Rev. Fr. Etud. Clin. Biol. (1964) v. 9 p. 819-828. Source: Available from The British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

Translated from Rev. Fr. Etud. Clin. Biol. (1964) v. 9 p. 819-828.

For this experiment, guinea-pigs were sensitized by two injections, with a twelve day interval between, consisting of a mixture of quartz + homologous phagocyte cells + homologous serum + Freund's adjuvant. In parallel, by way of control, a set up of guinea-pigs were given an identical preparation in which the quartz was replaced by beryllium oxide. The results of this experiment indicated on the one hand, that quartz and beryllium oxide, in the form of particles, were not antigenic and on the other, that the homologous serum, added to the above-mentioned types of dust, did not show modifications capable of making it auto-antigenic. (author).

53826 (HSE-Trans–13564A) **Comparative dynamic study of the intra-alveolar cellular population after intratracheal injection of beryllium hydroxide and aluminium hydroxide in rats.** Fritsch, P. (Atomic Energy Commission, Montrouge (France). Dept. of SPTE Protection Experimental Toxicology Lab.); Masse, R.; Stanislas, G.; Chretien, J. Health and Safety Executive, London (UK). Jan 1990. 10p. Translated from Biomedicine (1975) v. 23 p. 97-102. Source: Available from The British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

Translated from Biomedicine (1975) v. 23 p. 97-102.

A sequential quantitative study of the population of polymorphonuclears, lymphocytes and macrophages was made on a batch of S.P.F. rats between the 1st and 20th day after intratracheal injection of $Be(OH)_2$ or $Al(OH)_3$. The beryllium inhibited DNA synthesis in the intra-alveolar cells and made it possible to show up the transeptal cellular flow. The aluminium, over the same time span, caused reactions comparable to those due to beryllium without inhibiting the intra-alveolar multiplication of lymphocytes and macrophages. The quantitative variations in the populations which were observed clearly showed up the existence of local factors controlling the afflux of migratory cells and made it possible to distinguish a lymphocytary control over the division of the alveolar macrophages. (author).

53827 (IPEN-PUB–287) **The anesthetics influence (ethilic-eter and urethane) on renal radiopharmaceuticals.** Muramoto, E.; Achando, S.S.; Araujo, E.B. de; Hamada, H.S.; Silva Valente Goncalves, R. da; Pereira, N.P.S. de; Silva, C.P.G. da. Instituto de Pesquisas Energeticas e Nucleares (IPEN), Sao Paulo, SP (Brazil). Jan 1990. 13p. (In Portuguese). Order Number DE91605795. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

A comparative study was done using anesthetics like ether ethilic and urethane, in rats (Wistar). A significative variation was observed in the results obtained when renal radiopharmaceuticals were investigated. Using urethane, the renal uptake increase progressively due to the inhibition of the renal filtration and it starts to recuperate when the anesthetic effect was eliminated. Using ether ethilic the radiopharmaceuticals are quickly eliminated from the kidneys (tubular or glomerular filtration), showing that the renal function was protected. (author).

53828 (IPEN-PUB–288) **Stability and biological behaior of N-isopropil-p ^{131}I-anfetamin (Imp-^{131}I) and correlation to spinal cord.** Muramoto, E.; Achando, S.S.; Barboza, M.R.F.F. de; Silva Valente Goncalves, R. da; Colturato, M.T.; Pereira, N. da P.S. de; Silva, C.P.G. da. Instituto de Pesquisas Energeticas e Nucleares (IPEN), Sao Paulo, SP (Brazil). Jun 1990. 13p. (In Portuguese). Order Number DE91605796. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

Biodistribution studies were perfomed in rats after intravenous ly injection. The uptake in the brain and lung were rapid at 5 min and it kept almost constant from 15 to 240 min. The uptake in the spinal cord was higher between 15 and 60 min. and decrease at 240 min. and 24 hours. In the correlation study with the spinal cord a higher uptake in the lung was observed in 5 min. with a rapid decrease after 15 min. The stability of ^{131}I-IMP during 12 days was 94,12% at 4^0C and can be used up to seven days after the labelling when the radiochemical purity is 93,07%. (author).

53829 (MIC–90-04388/XAB) **Catalogue of data on thorium intake, organ burden, and excretion. Research report No. INFO-0330.** Senes Consultants, Willowdale, ON (Canada). ©1989. 64p. Source: NTIS, PC EE07/MF E01.

The Board is initiating the critical evaluation of current biokinetic and dosimetric models applicable to estimating exposure to the common chemical and physical forms of thorium encountered. The identification and location of the relevant sets of data are the first steps of this project. This report describes the collection methods and presents catalogues of the data on human and animal studies resulting from exposures under controlled experimental conditions, chronic occupational or environmental situations and actual accidental conditions. The data was identified through the use of computerized literature searches, library research and telephone contact with currently active researchers in the field.

53830 (MIC–90-04392/XAB) **Literature review of the studies on uptake, retention, and distribution of radionuclides by the fetus. Research report No. INFO-0332.** Lamothe, E.S. Atomic Energy Control Board, Ottawa, ON (Canada). ©1989. 26p. Source: NTIS, PC EE07/MF E01.

Summary of the available literature from the last 10 years dealing with studies on uptake, retention and distribution of radionuclides by an embryo or fetus following maternal intakes. The review concentrates on isotopes commonly used by Canadian licensees. Very little human data is available and a large fraction of the quoted values for human fetal dose retention are obtained from extrapolation from animal experiments.

53831 (MIC–90-04396/XAB) **Uniform application of ALARA to all radiation workers. Paper No. INFO-0329.** Pomroy, C. Atomic Energy Control Board, Ottawa, ON (Canada). ©1988. 18p. Source: NTIS, PC EE07/MF E01.

New information on the dosimetry and epidemiology of the atomic bomb survivors suggests that risk estimates may have to be revised upwards. This has focused increased attention on the ALARA principle, or optimization, as it is now known. This report explains optimization and the methods used in calculating it. It then applies the principle to various types of radiation workers in the nuclear industry, broadly interpreted to mean all licensed uses of radioactive material, including power utilities, uranium mine operators, and medical and research uses of radioactivity or radiation. An alternative approach to optimization calculation is suggested which entails the identification of sub-groups of workers with substantially higher doses to first discover the reasons for the higher than average doses, and to develop means to reduce them to the overall average.

53832 (MIC–90-04407/XAB) **Uncertainty in exposure of underground miners to radon daughters and the effect of uncertainty on risk estimates: A research report. Research report No. INFO-0334.** Senes Consultants, Willowdale, ON (Canada). ©1989. 325p. Source: NTIS, PC EE17/MF E01.

An important problem in all epidemiological studies of underground miners is the reliability of the estimates of the miners exposures. This study examines the various sources of uncertainty in exposure estimation for the principal epidemiologic studies reported in the literature, including the temporal and spatial variability of radon sources and changes to both mining methods and ventilation conditions. Uncertainties about work histories and the role of other hard rock mining experience are also discussed. The report also describes 2 statistical approaches, both based on Bayesian methods, by which the effects on the estimated risk coefficient of uncertainty in exposure can be examined. The regression model approach is applied to several published data sets from epidemiological studies of miners. Specific results are provided for each data set and apparent differences in risk coefficients are discussed. The studies of miners in the U.S., Ontario and Czechoslovakia are argued to provide the best basis for risk estimation at this time.

53833 (ORNL–6621) **Health and Safety Research Division progress report, October 1, 1988–March 31, 1990.** Oak Ridge National Lab., TN (USA). Sep 1990. 157p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE91000521. Source: NTIS, PC A07/MF A01; OSTI; INIS; GPO Dep.

The Health and Safety Research Division (HASRD) of the Oak Ridge National Laboratory (ORNL) continues to maintain an outstanding program of basic and applied research displaying a high level of creativity and achievement as documented by awards, publications, professional service, and successful completion of variety of projects. Our focus is on human health and the scientific

basis for measurement and assessment of health-related impacts of energy technologies. It is our custom to publish a division progress report every 18 months that summarizes our programmatic progress and other measures of achievement over the reporting period. Since it is not feasible to summarize in detail all of our work over the period covered by this report (October 1, 1988, to March 30, 1990), we intend this document to point the way to the expensive open literature that documents our findings. During the reporting period the Division continued to maintain strong programs in its traditional areas of R&D, but also achieved noteworthy progress in other areas. Much of the Division's work on site characterization, development of new field instruments, compilation of data bases, and methodology development fits into this initiative. Other new work in tunneling microscopy in support of DOE's Human Genome Program and the comprehensive R&D work related to surface-enhanced Raman spectroscopy have attained new and exciting results. These examples of our progress and numerous other activities are highlighted in this report.

53834 (ORNL/TM–11618) **A user's manual for ALDOSE: A computer code for calculating absorbed-dose rate, dose-equivalent rate, and dose-weighted LET as functions of depth in water irradiated by an alpha disc source.** Huston, T.E.; Turner, J.E. Oak Ridge National Lab., TN (USA). Aug 1990. 17p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE91000532. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

ALDOSE is a Fortran computer code written to calculate the absorbed-dose rate, dose-equivalent rate, and dose-weighted LET as functions of depth in water irradiated by a uniform alpha disc source. In addition, the average LET and average quality factor for the irradiated water are computed. The program accommodates a source upon which a layer of gold may reside and which may be separated from the water by a sheet of Mylar. The presence of gold and/or Mylar is optional and must be specified by the user. ALDOSE can process a source having up to 12 alpha energies ($\leq$15 MeV) in its spectrum. Lateral dimensions of the source are assumed to be large when compared to alpha-particle ranges in water. Calculations are based on range-energy tables for alphas in gold, Mylar, and water and employ a technique of ray tracing. Output data are tabulated as histograms and graphs in files which can be accessed by the user for further processing and plotting.

53835 (UCRL-JC–104817) **Laser-based flow cytometric analysis of genotoxicity of humans exposed to ionizing radiation during the Chernobyl accident.** Jensen, R.H. (Lawrence Livermore National Lab., CA (USA)); Bigbee, W.L.; Langlois, R.G.; Grant, S.G.; Pleshanov, P.G.; Chirkov, A.A.; Pilinskaya, M.A. Lawrence Livermore National Lab., CA (USA). 12 Sep 1990. 9p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-48. (CONF-9008142–2: Laser applications in life science, Moscow (USSR), 17-31 Aug 1990). Order Number DE91000809. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

An analytical technique has been developed that allows laser-based flow cytometric measurement of the frequency of red blood cells that have lost allele-specific expression of a cell surface antigen due to genetic toxicity in bone marrow precursor cells. Previous studies demonstrated a correlation of such effects with the exposure of each individual to mutagenic phenomena, such as ionizing radiation, and the effects can persist for the lifetime of each individual. During the emergency response to the nuclear power plant accident at Chernobyl, Ukraine, USSR, a number of people were exposed to whole body doses of ionizing radiation. Some of these individuals were tested with this laser-based assay and found to express a dose-dependent increase in the frequency of variant red blood cells that appears to be a persistent biological effect. All data indicate that this assay might well be used as a biodosimeter to estimate radiation dose and also as an element to be used for estimating the risk of each individual to develop cancer due to radiation exposure. 17 refs., 5 figs.

53836 (WSRC-RP–90-421) **Lysimeter study of vegetative uptake from saltstone.** Murphy, C.E. Jr. Westinghouse Savannah River Co., Aiken, SC (USA). 8 Jun 1990. 47p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC09-89SR18035. Order Number DE91000507. Source: NTIS, PC A04/MF A01 - OSTI; GPO Dep.

At the Savannah River Site, liquid, low-level nuclear waste will be disposed of by incorporating the waste in concrete, a wasteform called saltstone. Saltstone monoliths will then be buried in the earth. To study the potential uptake of radionuclides by trees and other plants growing in the soil in the area containing buried saltstone, a lysimeter study has been in progress since 1984. Thirty two lysimeters were designed, constructed, and filled with soil. Saltstone samples, containing the liquid, low-level supernate from the tank 50 in-tank precipitation demonstration, were buried in some of the lysimeters. Other lysimeters, not containing saltstone, were used as controls. Crops, grass, and trees were planted in the lysimeters and sampled periodically to determine radionuclide concentrations. Water samples were also collected from the lysimeter sumps and analyzed for radionuclide content. This report documents the results of vegetative and lysimeter sump water measurements from the beginning of the project in November of 1984 through September of 1989. 6 refs., 22 figs., 6 tabs.

53837 **Genetic effects from internally deposited radionuclides.** 48p. National Council on Radiation Protection and Measurements, Bethesda, MD (USA) (1987).

Technical Report NCRP 89.

It was learned in the late 1920's that ionizing radiation could produce genetic effects such as gene mutations and chromosome aberrations. However, at least until 1945, the focus on interest in radiation protection was primarily on somatic effects manifested in the individual exposed. Studies of the genetic effects of radiation using drosophila, however, refocused attention on effects transmitted to the exposed individuals offspring and concern over fallout in the 1950's resulted in efforts to estimate the genetic effects from exposure of human populations to internally deposited radionuclides. No human populations have been identified with burdens of internally deposited radioactive materials which have been shown to produce evidence of transmissible genetic damage. As a result, the research approach has been one in which macromolecular, cellular, and whole animal genetic studies have been combined to estimate genetic effects on humans following the deposition of radioactive materials in the body. The purpose of this report is to update the information available from animal and cellular experiments that relates genetic effects to deposited activity and dose from internally deposited radioactive materials.

53838 **Decreased pulmonary clearance of $^{239}PuO_2$ and lung toxicity induced by inhaled beryllium metal in rats.** Finch, G.L. (Lovelace Inhalation Toxicology Research Institute, Albuquerque, NM (USA)); Hoover, M.D.; Haley, P.J.; Eidson, A.F.; Mewhinney, J.A.; Cuddihy, R.G. pp. 21 of The toxicologist. Volume 10. Society of Toxicology, Washington, DC (US) (1990). pp. 435 (CONF-900284–: 29. annual meeting of the Society of Toxicology, Miami Beach, FL (USA), 12-16 Feb 1990).

Workers in nuclear industries may be accidentally exposed to both beryllium and plutonium. To characterized the effects of combined exposures to these agents on their pulmonary clearance, groups of F344/N rats inhaled aerosols of beryllium metal and $^{239}PuO_2$ to result in initial lung burdens for beryllium metal of 0, 50, 150, and 450 μg, and for $^{239}PuO_2$ of 0, 56, and 170 Bq. Rats were exposed to each possible beryllium/plutonium combination. The whole-body clearance half time of ^{239}Pu in the absence of beryllium metal was approximately 50 days. For rats exposed to both materials, however, ^{239}Pu clearance half-times ranged from 280 to 410 days, with no apparent dose-dependent effect of beryllium metal. Analysis of the lungs for both agents confirmed this pattern of retention. The lungs of beryllium metal-exposed rats displayed a hemorrhagic, exudative pneumonitis, with an influx of neutrophils, and later, progressive fibrosis accompanied by macrophage and epithelial cell hyperplasia. Enhanced $^{239}PuO_2$ retention will increase the radiation dose to the lung and may result in an eventual synergistic neoplastic response in rats exposed to the two agents.

53839 **Cytogenetic techniques in biological dosimetry: Overview and example of dose estimation in ten persons exposed to gamma radiation in the 1984 Mexican sup 60Co accident.** Littlefield, L.G. (Medical and Health Sciences Div., Oak Ridge Assoc. Universities, Oak Ridge, TN (US)); Joiner, E.E.;

Hubner, K.F. pp. 109-126 of Medical management of radiation accidents. Mettler, F.A. Jr.; Kelsey, C.A.; Ricks, R.C. CRC Press Inc., Boca Raton, FL (USA) (1990). pp. 396

In radiation accidents in which persons are at risk for either intermittent or protracted exposures for periods of several days to several weeks, it is not possible to accurately reconstruct their exposure scenarios, and for this reason physical estimates of dose become quite tenuous. In such instances, biological indicators provide the only realistic measures of dose absorbed by various persons. The authors cytogenetic evaluations in ten persons having potential exposures to ^{60}Co gamma radiation in the recent Mexican accident provided evidence that each had received radiation overexposures. To derive limiting estimates of doses for each person from the cytogenetic findings, they used in vitro dose-response models for dicentric induction in human lymphocytes. Dose estimates were made assuming that the exposures occurred either as a single acute event or protracted at a continuous low rate. These theoretical calculations provide estimates of the minimum and maximum doses of ^{60}Co radiation that could have yielded the observed dicentric frequency.

53840 **Management of skin and wound contamination.** Poda, G.A. (Dept. of Occupational Medicine, Oak Ridge Assoc. Universities, Oak Ridge, TN (US)). pp. 199-206 of Medical management of radiation accidents. Mettler, F.A. Jr.; Kelsey, C.A.; Ricks, R.C. CRC Press Inc., Boca Raton, FL (USA) (1990). pp. 396

Since one seldom incurs radioactive contaminated injury without some external body contamination, the authors review external decontamination in preparation for treating the injuries that might occur. Good judgment is essential in determining decontamination priorities. Since some radioactive materials are corrosive or toxic because of their chemical properties, medical attention might have to be directed first to a nonradiological problem if radioactive materials were shipped as acids, fluorides (uranium hexafluoride-UF_6), mercury, or lead compounds. In general, contaminated wounds and body orifices are decontaminated first, followed by areas of highest contamination levels on the intact skin. The authors discuss how the purpose of decontamination is to prevent or reduce incorporation of the material (internal contamination), to reduce the radiation dose from the contaminated site to the rest of the body, to contain the contamination, and to prevent its spread.

5602 Thermal Effects

Refer also to citation(s) 53695, 53810

5603 Chemicals Metabolism and Toxicology

Refer also to citation(s) 52672, 52740, 52879, 53646, 53649, 53652, 53663, 53674, 53678, 53690, 53691, 53692, 53697, 53756, 53757, 53774, 53778, 53780, 53833

53841 (AD-A-224022/4/XAB) **Mechanisms of halocarbon-induced hepatotoxicity in the mouse. Final report, 1 April 1989-31 March 1990.** Smith, M.A.; Gandy, J. Arkansas Univ. for Medical Sciences, Little Rock, AR (USA). 30 May 1990. 73p. Grant AFOSR-89-0344. Source: NTIS, PC A04/MF A01.

Previous studies have shown that high-dose exposure to the halocarbon bromobenzene resulted in hepatotoxicity and lethality that was substantially diminished by co-treatment with the alpha-adrenergic antagonist, phentolamine. The purpose of this study was to compare the hepatoxicity resulting from exposure to the related halocarbons, chlorobenzene, bromobenzene and iodobenzene, and to determine whether the resulting hepatotoxicity could be antagonized by phentolamine. Halobenzene-induced changes in hepatic glutathione concentrations and serum concentrations of catecholamines were determined as possible mediators of hepatic damage. Iodobenzene administration resulted in toxicities similar to that seen with bromobenzene. Administration of either iodobenzene or bromobenzene resulted in hepatotoxicity as measured by serum alanine aminotransferase (ALT) activity about 1000 fold above normal values. Chlorobenzene was also capable of producing hepatotoxicity, but not to the same extent as iodobenzene. Chlorobenzene-induced hepatotoxicity resulted in serum ALT values approximately 100 fold above normals. Chlorobenzene, bromobenzene or iodobenzene administration significantly decreased hepatic glutathione concentrations to approximately 20% of control concentrations. Phentolamine co-treatments significantly decreased serum ALT activity for all three compounds suggesting that hepatotoxicity might be mediated through an alpha-adrenergic system.

53842 (AD-A-224329/3/XAB) **Transformation and precipitation of toxic metals by Pseudomonas maltophilia. Annual report, 1 May 1989-30 April 1990.** Blake, R. Meharry Medical Coll., Nashville, TN (USA). 31 May 1990. 9p. Contract F49620-89-C-0052. Source: NTIS, PC A02/MF A01.

The aims of this research are to study each of the various molecular mechanisms whereby toxic metal cations and oxyanions are chemically transformed by Pseudomonas maltophilia strain OR-02. The research effort for the current year has focused on the microbial-dependent transformations of selenite, tellurite, lead, and chromate. The reduction of selenite and tellurite to their insoluble elemental forms appeared to be mediated by an intracellular glutathione reductase that utilized the spontaneously-formed bis(glutathio)Se or bis(glutathio)Te, respectively, as pseudosubstrates. The biomolecules responsible for the extracellular transformation of lead and the reduction of chromate to Cr(III) are currently under investigation. This project could provide useful information toward the eventual exploitation of P. maltophilia and related organisms for the removal of toxic metal wastes from selected, heavily polluted sites.

53843 (DOE/ER/13457-T1) **Biosafety in the laboratory: Prudent practices for the handling and disposal of infectious materials: [Final report].** National Research Council, Washington, DC (USA). Committee on Hazardous Biological Substances in the Lab. ©1989. 232p. Sponsored by U.S. Department of Defense; U.S. DOE Energy Research; National Science Foundation. DOE Contract FG05-85ER13457. Contract DAMD17-86-G-6022 Grant DMB-8611553. Source: National Academy Press, 2101 Constitution Ave. NW, Washington, DC 20418; $29.95.

This book is about the safe handling and disposal of hazardous biological materials in the laboratory. These materials consist of infectious agents, per se, as well as substances actually or potentially contaminated with them. The general concepts set forth in this book apply to many types of laboratories: academic, industrial, and governmental research laboratories; hospital, physicians', veterinarians', and dentists' laboratories; teaching laboratories; blood banks; and analytical laboratories that handle potentially infectious materials (e.g., clinical, diagnostic, and food laboratories). We have included a section on biosafety in large-scale production facilities, because laboratory workers are often involved in the scale-up of benchtop operations to the pilot plant level. We have restricted ourselves to agents infectious to humans. This book is designed to serve as an introductory guide to biological safety in the laboratory; the principles and practices described, however, are general ones, and the readers must decide how best to apply them in their own circumstances. Specific applications will vary with such factors as the design of the local facility and equipment, the procedures in use, the nature of the potential exposure, and the workers' susceptibility. 151 refs., 12 figs., 3 tabs.

53844 (HSE-Trans-13561B) **Immunological characterisation of groups of people exposed to beryllium as a result of burning coal with high contents of this toxin.** Bencko, V. (Karlova Univ., Prague (Czechoslovakia)); Vasilieva, E.V.; Tichy, V.; Konopikova, L.; Horecka, J.; Symon, K. Health and Safety Executive, London (UK). Jan 1990. 14p. Translated from Ceskoslovenska Hygiena (1978) v. 23(1) p. 11-20. Source: Available from The British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

Translated from Ceskoslovenska Hygiena (1978) v. 23(1) p. 11-20.

An epidemological study was made of persons occupationally (39) and non-occupationally (34) exposed to relatively low concentrations of beryllium in air as a result of coal combustion. Beryllium concentrations in the workplace were between 30 and 800×10^{-5} $mg.m^{-3}$, and in the town of Sokolov $1.68\text{-}0.39 \times 10^{-5}$ $mg.m^{-3}$. Radial immunodiffusion was used to determine main immunoglobulin

classes, and the passive haemagglutination reaction used to determine antibodies (lungs, heart, liver, spleen, thyroid) and antibodies to nuclear (ANA) and mitochondrial (AMA) antigens in intact rat lungs and rats with experimental beryllosis. In both exposed groups significant increase in IgG and IgA and autoantibodies was found compared with controls (60). Specific AMA and ANA were found in exposed groups (higher values in women). (UK).

53845 (KFK-PEF-61-Vol.1) **6th status colloquium of the PEF project, on March 6-8, 1990 at Karlsruhe Nuclear Research Center.** Horsch, F.; Filby, W.G.; Fund, N.; Gross, S.; Hanisch, B.; Reinhardt, W.; Seidel, A. (comps.). Kernforschungszentrum Karlsruhe GmbH (Germany, F.R.). Projekt Europaeisches Forschungszentrum fuer Massnahmen zur Luftreinhaltung (PEF). Apr 1990. 358p. (In German). (CONF-9003218--Vol.1: 6. PEF status colloquium of Kernforschungszentrum Karlsruhe, Karlsruhe (Germany, F.R.), 6-8 Mar 1990). Order Number DE91716972. Source: NTIS (US Sales Only), PC A16/MF A01.

During March 6-8, 1990 the sixth status report of the project 'European Research Center for Air Pollution Control Measures' took place at the Nuclear Research Center Karlsruhe. Progress reports on the following topics were presented: investigation into damage and elucidation of the causes and effects of forest decline (30 lectures); air pollution effects on human health (11 lectures); research into atmospheric dispersion, conversion and deposition of airborne pollutants (7 lectures); development and optimization of industrial-technical processes to reduce or avoid emissions (8 lectures); providing instruments and making recommendations to the industrial and political sectors (4 lectures). Separate abstracts were prepared for 56 lectures of these proceedings. (orig./MG).

53846 (KFK-PEF-62) **6th status colloquium of the PEF project, on March 6-8, 1990 at Karlsruhe Nuclear Research Center. Summarizing reviews of the program management.** Kernforschungszentrum Karlsruhe GmbH (Germany, F.R.). Projekt Europaeisches Forschungszentrum fuer Massnahmen zur Luftreinhaltung (PEF). Apr 1990. 86p. (In German). (CONF-9003218--: 6. PEF status colloquium of Kernforschungszentrum Karlsruhe, Karlsruhe (Germany, F.R.), 6-8 Mar 1990). Order Number DE91712335. Source: NTIS (US Sales Only), PC A05/MF A01.

This report compiles the summarizing reviews of the program management in the final session of the 6th status colloquium. The full papers to which the summaries refer, are published in KfK-PEF 61. (orig.).

53847 (PB-90-238437/XAB) **Drinking-water criteria document for beryllium. Draft report (Final).** Olsen, J. Environmental Protection Agency, Cincinnati, OH (USA). Office of Environmental Criteria and Assessment. Jan 1990. 169p. (ECAO-CIN-D-003). Source: NTIS, PC A08/MF A01.

Beryllium (Be) is a hard grayish-white metal of the alkaline earth family. The major route of exposure by which beryllium enters the body is inhalation. Beryllium also occurs naturally in various tobaccos and may be inhaled during smoking. The greatest potential for beryllium exposure occurs in the work place and in the vicinity of the industries that process beryllium ore or compounds. Although evidence exists that beryllium is a carcinogen by the inhalation route, no definitive evidence exists that correlates the ingestion of beryllium with tumor appearance since it has not been tested orally at the MTD. However, since beryllium is carcinogenic by inhalation and parenteral routes, and also induces chromosomal abnormalities, it is possible that beryllium in water could pose a carcinogenic risk to man.

53848 (PB-90-245093/XAB) **Lead poisoning: The invisible disease. Waterfowl Management handbook.** Friend, M. National Wildlife Health Research Center, Madison, WI (USA). 1989. 7p. (FISH/WILDLIFE-LEAFLT-13-2-6). Source: NTIS, PC A02/MF A01.

Lead poisoning is an intoxication resulting from absorption of hazardous levels of lead into body tissues. Lead pellets from shot shells, when ingested, are the most common source of lead poisoning in migratory birds. Other far less common sources include lead fishing sinkers, mine wastes, paint pigments, bullets, and other lead objects that are swallowed. Lead poisoning has affected every major species of waterfowl in North America and has also been reported in a wide variety of other birds. The annual magnitude of lead poisoning losses for individual species cannot be precisely determined. However, reasonable estimates of lead-poisoning losses in different species can be made on the basis of waterfowl mortality reports and gizzard analyses. Within the United States, annual losses from lead poisoning have been estimated at between 1.6 and 2.4 million waterfowl, based on a fall flight of 100 million birds.

53849 (PB-90-256371/XAB) **Toxicology and carcinogenesis studies of toluene (CAS No. 108-88-3) in F344/N rats and B6C3F1 mice (inhalation studies). Technical report series.** Huff, J. National Toxicology Program, Research Triangle Park, NC (USA). Feb 1990. 251p. (NTP-TR-371). Source: NTIS, PC A12/MF A02.

Toxicology and carcinogenesis studies were conducted by whole-body inhalation exposure of 50 F344/N rats of each sex and 50 B6C3F1 mice of each sex to 0, 120 (mice only), 600, or 1,200 ppm toluene 6.5 hours per day, 5 days per week, for 103 weeks. Under the conditions of these 2-year inhalation studies, there was no evidence of carcinogenic activity for male or female F344/N rats exposed to toluene at concentrations of 600 or 1,200 ppm. There was no evidence of carcinogenic activity for male or female B6C3F1 mice exposed by inhalation to toluene at concentrations of 120, 600, or 1,200 ppm for 2 years.

53850 (PB-90-263153/XAB) **EPA perspective on biomarkers research: How do you get there from here.** Fowle, J.R. Environmental Protection Agency, Research Triangle Park, NC (USA). Health Effects Research Lab. 1990. 7p. (EPA-600/D-90/124). Source: NTIS, PC A02/MF A01.

Two primary forces drive EPA's biomarker research efforts: advances in the state-of-the-science and the need to reduce uncertainties in health risk assessment. Scientific advances in molecular biology over the past few decades have resulted in an increased understanding of life processes. This knowledge coupled with advances in clinical chemistry, toxicology, and occupational medicine provides scientists with techniques to evaluate human tissues, fluids and breath samples for evidence of chemical exposure and biological effects. EPA's office of Research and Development evaluated the current status of biomarkers with respect to risk assessment needs to develop an EPA health research strategy for biomarkers. The initial focus will be on measures for exposure evaluation. The paper discusses EPA's biomarker strategy emphasizing ways biomarkers can be employed in TEAM Studies.

53851 (PB-90-263237/XAB) **Determination of Monod kinetics of toxic compounds by respirometry for structure-biodegradability relationships.** Govind, R.; Desai, S.; Tabak, H.H. Environmental Protection Agency, Cincinnati, OH (USA). Risk Reduction Engineering Lab. ©1990. 23p. (EPA-600/D-90/134). Source: NTIS, PC A03/MF A01.

The key to the evaluation of the fate of toxic organic chemicals in the environment is dependant on evaluating their susceptibility to biodegradation. Biodegradation is one of the most important mechanisms in controlling the concentration of chemicals in an aquatic system because toxic pollutants can be mineralized and rendered harmless. Experiments using an electrolytic respirometer have been conducted to collect oxygen consumption data of toxic compounds from the list of RCRA and RCRA land banned chemicals (phenols and phthalates). The estimation of Monod kinetic parameters were obtained for all the compounds by a graphical method. The first order kinetic constants for the substituted phenols were related to the structure of the compounds by the group contribution method.

53852 (PB-90-264185/XAB) **Degradation of halogenated aliphatic compounds by the ammonia-oxidizing bacterium Nitrosomonas europaea.** Vannelli, T.; Logan, M.; Arciero, D.M.; Hooper, A.B. Minnesota Univ., St. Paul, MN (USA). Dept. of Genetics and Cell Biology. ©1990. 5p. Grant EPA-R-816157. Source: NTIS, PC A01/MF A01.

Pub. in Applied and Environmental Microbiology, Vol. 56, No. 4, 1169-1171(Apr 1990).

Suspensions of Nitrosomonas europaea catalyzed the ammonia-stimulated aerobic transformation of the halogenated aliphatic compounds dichloromethane, dibromomethane, trichloromethane (chloroform), bromoethane, 1,2-dibromoethane (ethylene dibromide), 1,1,2-trichloroethane, 1,1,1-trichloroethane, monochloroethylene (vinyl chloride), gem-dichloroethylene, cis- and

trans-dichloroethylene, cis-dibromoethylene, trichloroethylene, and 1,2,3-trichloropropane. Tetrachloromethane (carbon tetrachloride), tetrachloroethylene (perchloroethylene), and trans-dibromoethylene were not degraded.

53853 (PB–90-264698/XAB) **Isolation and characterization of a fluoranthene-utilizing strain of Pseudomonas paucimobilis.** Mueller, J.G.; Chapman, P.J.; Blattmann, B.O.; Pritchard, P.H. Environmental Protection Agency, Gulf Breeze, FL (USA). Environmental Research Lab. ©1990. 10p. (EPA–600/J-90/109). Source: NTIS, PC A02/MF A01.

Pub. in Applied and Environmental Microbiology, Vol. 56, No. 4, 1079-1086(Apr 1990).

Fluoranthene, a high molecular weight PAH containing four fused rings, is naturally present in fossil fuels and derivatives thereof, and may be formed during the combustion of carbonaceous materials. To date, there have been no reports of the primary utilization by pure microbial cultures of fluoranthene or of other PAHs containing four or more fused rings. Recently a 7-membered bacterial community isolated from a creosote-waste site was described for its ability to utilize fluoranthene as a sole carbon source. In the paper, a single member of this community is described, isolated in pure culture with the unique ability of utilizing fluoranthene as sole source of carbon and energy for growth.

53854 (PB–90-264813/XAB) **Determinants of polychlorinated biphenyls (PCBs), polybrominated biphenyls (PBBs), and dichlorodiphenyl trichloroethane (DDT) levels in the sera of young children.** Jacobson, J.L.; Humphrey, H.E.B.; Jacobson, S.W.; Schantz, S.L.; Mullin, M.D. Wayne State Univ., Detroit, MI (USA). ©1989. 6p. Grants EPA-R-80852010, PHS-ES-03256. Source: NTIS, PC A02/MF A01.

Serum samples from 285 4-year old Michigan children were evaluated for levels of 11 environmental contaminants. Polychlorinated biphenyls (PCBs) were found in half the samples tested; polybrominated biphenyls (PBBs) in 13-21%; dichlorodiphenyl trichloroethane (DDT), in more than 70%. Nursing (Mothers milk) was the principal source of these exposures. Congener-specific analysis documented the presence of at least one highly toxic PCB congener, 2,3',4,4',5-pentachlorobiphenyl. The data demonstrate the multigenerational impact of female exposure to persistent organic environmental contaminants.

53855 (PB–90-264938/XAB) **^{32}P-postlabeling analysis of aromatic DNA adducts in fish from polluted areas.** Dunn, B.P.; Black, J.J.; Maccubbin, A. British Columbia Cancer Research Center, Vancouver, BC (Canada). Environmental Carcinogenesis Unit. ©1987. 7p. Grant EPA-812575. Source: NTIS, PC A02/MF A01.

Pub. in Cancer Research, Vol. 47, 6543-6548(15 Dec 1987).

Brown bullheads (Ictalurus nebulosus) were sampled from sites in the Buffalo and Detroit Rivers where fish are exposed to high levels of sediment bound polycyclic aromatic hydrocarbons, and suffer from an elevated frequency of liver cancer. DNA was isolated from the livers of these wild fish and from control specimens which were raised in clean aquariums. DNA was enzymatically digested to normal and adducted nucleotides, and hydrophobic/bulky adducts were enriched in the digests either by preparative reverse-phase high-pressure liquid chromatography, or selective nuclease P1 dephosphorylation of normal nucleotides. Aromatic DNA-carcinogen adducts were then quantitated using (32)P-postlabeling analysis. Using both adduct enrichment procedures, chromatograms derived from DNA of fish from polluted areas showed a diffuse diagonal radioactive zone not present in DNA from aquarium raised fish.

53856 (PB–90-264987/XAB) **Determination of 2,3,7,8-TCDD Toxic Equivalent Factors (TEFS): Support for the use of the in vitro AHH induction assay.** Safe, S. Texas A and M Univ., College Station, TX (USA). ©1987. 13p. Grant EPA-810995. Source: NTIS, PC A03/MF A01.

Pub. in Chemosphere, Vol. 16, No. 4, 791-802(1987).

The in vitro induction of the cytochrome P1-450-dependent monooxygenases, aryl hydrocarbon hydroxylase (AHH) or ethoxyresorufin O-deethylase (EROD) by 2,3,7,8-TCDD and related toxic halogenated aryl hydrocarbons in rat hepatoma H-4-II E cells has been developed as a short term quantitative bioassay for these toxic chemicals. There was a linear correlation between the -log EC50 (in vitro) AHH induction vs the -log ED50 (in vivo) for body weight loss, thymic atrophy, hepatic AHH and EROD induction in the rat for several polychlorinated biphenyl, dibenzo-p-dioxin and dibenzofuran congeners and mixtures. These data clearly support the utility of the in vitro AHH induction assay as a short term test system for quantitating the toxic or 2,3,7,8-TCDD equivalent in an extract containing toxic halogenated aromatics. The bioassay method is rapid, relatively accurate and much more cost effective than conventional analytical methods such as gas chromatography-mass spectrometry from which it is difficult to determine the levels of 2,3,7,8-TCDD equivalents in specific analytes.

53857 (PB–90-265117/XAB) **Polychlorinated dibenzo-p-dioxins and dibenzofurans: Correlation between in vivo structure-activity relationships (SARs).** Safe, S.; Mason, G.; Keys, B.; Farrell, K.; Zmudzka, B. Texas A and M Univ., College Station, TX (USA). ©1986. 8p. Grant EPA-810995. Source: NTIS, PC A02/MF A01.

Pub. in Chemosphere, Vol. 15, No. 9-12, 1725-1731(1986).

Polychlorinated dibenzofurans (PCDFs) and dibenzo-p-dioxins (PCDDs) elicit a number of common biologic and toxic responses which are triggered by their initial binding to a cytosolic receptor protein. These effects include the induction of several cytochrome P-448 dependent monoxygenases (eg, aryl hydrocarbon hydroxylase, AHH), body weight loss and thymic atrophy. The dose-response effects of selected PCDFs on AHH induction in rat hepatoma H-4-II E cells and cytosolic receptor binding affinities have been determined. The results of these in vivo and in vitro studies demonstrate the remarkable effects of structure on the activity of PCDFs. A systematic study of each of the four different position for chlorine substitution in the dibenzofuran ring system showed that the toxic and biologic potencies of these compounds varied with respect to differential chlorine substitution at all four position, i.e. C-3(7) > C-2(8) >C-4(6) > C-1(9). In vitro SARs for PCDDs confirmed the importance of the lateral Cl substituents and also showed that 1,2(or 6,7-) substituted PCDDs were more active than the corresponding 1,3-dichloro analogs. In addition, there were significant decreases in activity with increasing non-lateral Cl substitution. The SARs for PCDFs were different from the PCDDs and this was directly related to the asymmetric structure of the former group of compounds.

53858 (UBA-FB–86-055) **Assessment of the effects of diesel exhausts. Verbal minutes of the discussion held in the Umweltbundesamt on November 3, 1986.** Umweltbundesamt, Berlin (Germany, F.R.). 1986. 232p. (In German). Contract UFOPLAN-Nr. 10101045/02. Source: Copy held by UB/TIB Hannover.

5 pertinent studies are presented and discussed by an expert committee. The studies covered the following subjects: (1) Deposition of aerosol particulates in the human respiratory tract; (2) The actions and effects of exhaust gases in animal studies, espec. carcinogenic action; (3) Morphology of induced tumours; (4) Risk assessment. (MG).

53859 (UCRL–21001-90-1) **Progress report for the project: Comparison of the response of mature branches and seedlings of Pinus ponderosa to atmospheric pollution.** Houpis, J.L.J.; Anderson, P.D.; Benes, S.E.; Phelps, S.P.; Loeffler, A.T. Lawrence Livermore National Lab., CA (USA). Sep 1990. 28p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. Order Number DE91000802. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This progress report details Lawrence Livermore National Laboratory's (LLNL) performance regarding the projects "Comparison of the Response of Mature Branches and Seedlings of Pinus ponderosa to Atmospheric Pollution" and "Effects of Ozone, acid Precipitation, and Their Interactions on Mature Branches and Seedlings of Ponderosa Pine" for the months of November 1989 to June 1990. During the last eight months, we have initiated ozone and acid precipitation exposures, and we began intensive growth, morphological, and physiological measurements. During these major physiological measurement periods, we measured photosynthesis, transpiration, stomatal conductance, respiration, antioxidant activity, pigmentation, and foliar nutrient concentration. We have

also concluded the analysis of our branch autonomy experiment, which we conducted in the fall. We determined that virtually no carbon is exported among branches in close proximity to one another. This conclusion assists in validating the approach of using branches and branch exposure chambers as a means of assessing the effects of air pollution on mature trees of Ponderosa pine. 6 refs., 4 figs., 3 tabs.

53860 **Assessment of the biological effects of inorganic fibrous materials in animal experiments.** Johnson, N.F. (Inhalation Toxicology Research Institute, Albuquerque, NM (USA)). pp. 18 of The toxicologist. Volume 10. Society of Toxicology, Washington, DC (US) (1990). pp. 435 (CONF-900284--: 29. annual meeting of the Society of Toxicology, Miami Beach, FL (USA), 12-16 Feb 1990).

Animal inhalation experiments with asbestos have produced lesion similar to those seen in humans with known asbestos exposure (lung cancer, pulmonary and pleural fibrosis and mesothelioma). Similarly, inhalation experiments with glass fiber reflects what is known about the health hazards of these materials. Glass fibers do not elicit significant lesions in animals or show evidence of human neoplastic or fibrogenic activity. However, it may be impractical to test all the replacements for asbestos and new fibrous materials such as ceramic fibers and whiskers by the inhalation route, because of the expense and time involved. Other methods of administration of these materials to animals can provide useful information on the potential toxicity of fibrous materials. These routes of administration include intraperitoneal or intrapleural injection as well as intratracheal instillation. However, these methods can produce results different from those seen following inhalation of the material; for example, glass fibers do not produce lung tumors or mesothelioma by inhalation but they can be induced by intratracheal and intraperitoneal administration. There is sufficient evidence in the literature from a wide range of materials that have been tested by all of these routes to evaluate the significance that should be placed on the results from these individual approaches. The injection routes of administration indicate the potential of the material, however, caution must be exercised in their interpretation because the material is presented to the tissue in excessively high doses and in a non-physiological manner. Inhalation studies provide relevant exposure in a physiological manner and the data obtained from these studies can be used to derive No Observable Effect Levels (NOEL) and Reference Dose Values (RfDs).

53861 **Cadmium-induced formation of multinucleated osteoclast-like cells in vitro.** Konz, R.P. (Argonne National Laboratory, IL (USA)); Choi, T.T.; Seed, T.M. pp. 20 of The toxicologist. Volume 10. Society of Toxicology, Washington, DC (US) (1990). pp. 435 DOE Contract W-31-109-ENG-38. (CONF-900284--: 29. annual meeting of the Society of Toxicology, Miami Beach, FL (USA), 12-16 Feb 1990).

Mononuclear, progenitor-enriched bone marrow cells fuse into multinucleated osteoclast-like (MN-OS) cells during 10 to 20 days of culture. As cadmium (Cd) exposure has been linked to increased bone resorption, we asked if Cd would increase (1) MN-OS cell formation and (2) ^{45}Ca release from bone, when marrow cells were cultured in the presence of ^{45}Ca-prelabeled dog femur slices. Results show that, on day 21, the percentage of MN-OS cells ($\geq$3 nuclei/cell) was 1.4 $\pm$ 0.1% (mean $\pm$ SE, n=4) for control cultures (medium + bone slice + cells), 3.6 $\pm$ 0.1% for cultures with 10 nM parathyroid hormone (PTH) added, and 7.1 $\pm$ 1.5% with 10 nM Cd added. Starting on day 10, we found MN-OS cells with centrally located nuclei, a clear zone, and ruffled borders typical of activated osteoclasts; these activated cells appeared almost exclusively in the +Cd and +PTH cultures. During 21 days, 256 $\pm$ 9 CPM ^{45}Ca was released per well from the bone slices in cultures with cells, compared to 209 $\pm$ 11 CPM ^{45}Ca was released in cultures without cells (mean $\pm$ SE, n=16). However, neither Cd nor PTH significantly increased the cell-mediated release of ^{45}Ca. Thus, both Cd and PTH at 10 nM stimulated the formation of MN-OS cells; however, another factor may have been required to cause MN-OS cells of resorb bone.

53862 **Inhalation developmental toxicity of isoprene in mice and rats.** Mast, T.J. (Northwest Laboratory, Richland, WA (USA)); Rommereium, R.L.; Weigel, R.J.; Stoney, K.H.; Schwetz, B.A.; Morrissey, R.E. pp. 42 of The toxicologist. Volume 10. Society of Toxicology, Washington, DC (US) (1990). pp. 435 (CONF-900284--: 29. annual meeting of the Society of Toxicology, Miami Beach, FL (USA), 12-16 Feb 1990).

The developmental toxicity of isoprene was assessed in Sprague-Dawley rats and Swiss (DC-1) mice exposed to 0, 280, 1400, 7000 ppm isoprene vapors, 6 h/dy, 7 dy/wk, 6-17 days of gestation (dg) for mice and 6-19 dg for rats. Isoprene vapor was generated using a rotary evaporator and metered to the chambers using nitrogen as a carrier gas. There were no significant effects upon body weights or reproductive indices at any exposure level in rats, nor was there a significant increase in the incidence of fetal malformations or variations. An exposure-correlated increase in the incidence of reduced vertebral ossifications (centra) in the 7000-ppm group suggests this level may be at or near a developmental toxicity threshold. Pregnant mice in the 7000-ppm group had a significant reduction in maternal body weight and uterine weight. Developmental toxicity was evident in mice as a reduction in fetal body weight which became statistically significant at 280 ppm for females and at 1400 ppm for males. There was a statistically significant increase in the incidence of supernumerary ribs in mice for the 7000-ppm group. Although there was no significant increase in the incidence of malformations, two fetuses with cleft palate were found, one in each of the two highest exposure groups. The results indicate that 1400 ppm isoprene is a no observable effect level (NOEL) in the rat for both maternal and developmental toxicity. In mice, 1400 ppm is maternal NOEL; however, a NOEL for developmental toxicity in the mouse cannot be assigned based on the results of this study.

53863 **Development of photosynthetic activity in Porphyridium purpureum (Rhodophyta) following nitrogen starvation.** Levy, I. (Smithsonian Institution, Washington, DC (USA)); Gantt, E. *Journal of Phycology (USA)*, 26(1): 62-68 (Mar 1990). DOE Contract FG05-87ER13652.

The effects of nitrogen limitation on laboratory cultures of Porphyridium purpureum Bory, Drew and Ross were studied under continuous white light illumination (35 $\mu E \times m^{-2} \times s^{-1}$). Growth ceased, respiration exceeded photosynthesis, chlorophyll content was reduced by 80%, and phycoerythrin content was reduced by 99% over a period of 14 days under nitrogen limitation. Recovery upon addition of nitrogen resulted in increased phycobiliprotein content, appearance of phycobilisomes attached to the thylakoids, increased oxygen evolution, and increased fluorescence emission from photosystem 1 (720 nm) and photosystem 2 (685 nm) upon excitation by green light. Growth resumes after 72 h and was concomitant with an increase of chlorophyll, phycoerythrin and phycobilisomes per thylakoid area. The results suggest that photosystem 1 was less affected by nitrogen starvation than photosystem 2 and that the recovery was largely dependent on the restoration of phycobilisomes and other photosystem components.

53864 **Manganese regulates expression of manganese peroxide by Phanerochaete chrysosporium.** Brown, J.A. (Oregon Graduate Institute of Science and Technology, Beaverton (USA)); Glenn, J.K.; Gold, M.H. *Journal of Bacteriology (USA)*, 172(6): 3125-3130 (Jun 1990). DOE Contract FG06-86ER13550.

The appearance of manganese peroxidase (MnP) activity in nitrogen-limited cultures of Phanerochaete chrysosporium is dependent on the presence of manganese. Cultures grown in the absence of Mn developed normally and produced normal levels of the secondary metabolite veratryl alcohol but produced no MnP activity. Immunoblot analysis indicated that appearance of MnP protein in the extracellular medium was also dependent on the presence of Mn. Intracellular MnP protein was detectable only in cells grown in the presence of Mn. MnP mRNA was detected by Northern (RNA) blot analysis only in cells grown in the presence of Mn. If Mn was added to 4-day-old nitrogen-limited Mn-deficient cultures, extracellular MnP activity appeared after 6 h and reached a maximum after 18 h. Both actinomycin D and cycloheximide inhibited the induction of MnP activity by Mn. These results indicate that Mn, the substrate of the enzyme, is involved in the transcriptional regulation of the MnP gene.

5604 Other Environmental Pollutant Effects

Refer also to citation(s) 53833

53865 (CONF-9009221–4) **Relative potency as a means of evaluating ELF [Extremely Low Frequency] health risks.** Easterly, C.E.; Glass, L.R. Oak Ridge National Lab., TN (USA). Sep 1990. 14p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From 6. international symposium on gaseous dielectrics; Knoxville, TN (USA); 23-27 Sep 1990. Order Number DE91000727. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

In the 1970's, a variety of developments took place to heightened public and scientific interest in electromagnetic fields. During this time, biological studies of nonionizing electromagnetic fields were taking place, but no clear evidence of risks to public health was identified. Then came the surprising epidemiological finding suggesting that 60 Hz magnetic fields may be related to some childhood leukemias. Our particular interest at ORNL was how to interpret the available data with respect to human exposures to the nearly ubiquitous fields. A review of the available data showed that consistent biological effects were difficult to identify. Classical toxicological tests used in chemical risk assessment had not been performed with Extremely Low Frequency (ELF) fields but rather a wide range of mechanistic studies had been pursued. To evaluate the level of anticipated hazard or risk there was neither a mechanistic understanding nor a consistent phenomenological outcome. A risk evaluation normally requires one or the other of these two types of information. Two quite different approaches were pursued: meta-analysis and relative potency. The first of these is a method to combine data from similar experiments to enhance the relative statistical power of a collection of small sample size studies, and will not be discussed further. The second, relative potency, will be the focus of this paper. 20 refs., 2 figs.

53866 **Baboons exposed to electric fields do not show alterations in blood composition or chemistry.** Rogers, W.R. (Southwest Research Institute, San Antonio, TX (USA)). pp. 57 of The toxicologist. Volume 10. Society of Toxicology, Washington, DC (US) (1990). pp. 435 (CONF-900284–: 29. annual meeting of the Society of Toxicology, Miami Beach, FL (USA), 12-16 Feb 1990).

Some are concerned that high voltage power line represent a public health hazard. As part of a research program examining the possibility, experiments were conducted at 30 kV/m and at 60 kV/m in a specially-designed facility producing well-characterized, homogeneous, vertical electric fields. Each experiment included 14 field-exposed (12 hours per day) and 14 sham-exposed nonhuman primates (Papio cynocephalus) used as human surrogates. Blood samples collected, by venipuncture under ketamine sedation, from each subject during the fifth week of Pre-Exposure, Exposure, and Post-Exposure periods were subjected to conventional automated cell counting and biochemical analyses providing data on 41 dependent variables. Only three variables, serum cholesterol, alkaline phosphatase and gamma glutamyl transferase concentrations, show statistically significant between group differences in means during the Exposure period in both experiments. However, for each of these three variables, when data from Pre-Exposure and Post-Exposure periods also are considered, the pattern of results does not suggest occurrence of a field-related effect. As concluded in experiments with rodents, a few weeks of electric field exposure does not produce consistent, measurable effects on conventional physiologic indicators of general health.

57 HEALTH AND SAFETY

Refer also to citation(s) 53604, 53605, 53606, 53607, 53608, 53609, 53610, 53611, 53612, 53613, 53614, 53615, 53616, 53617, 53618, 53619, 53620, 53621, 53622, 53623, 53624, 53625, 53626, 53627, 53628, 53629, 53630, 53631, 54438

58 GEOSCIENCES

Refer also to citation(s) 53358, 53492, 53560, 53698, 54417

53867 (DOE/ET/44802–T24) **Bouguer gravity anomaly map of Nevada: Map 94A.** Saltus, R.W. (Geological Survey, Denver, CO (USA)). Nevada Bureau of Mines and Geology, Reno, NV (USA). 1988. 18p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AI08-78ET44802. Source: US Geological Survey, Map Distribution, Federal Center, Box 25286, Denver, CO 80225.

This map depicts the complete Bouguer gravity of Nevada with 5 mGal (1 mGal = 10^{-5} m/s^2) contour lines. A Bouguer gravity reduction density of 2.67 g/cm^3 was used. The variations in the acceleration of gravity shown on this map are an indirect measure of lateral variations in the density of the Earth. In many cases these lateral density variations are geologically significant boundaries such as faults, folds, unconformities, or facies changes. 25 refs.

53868 (DOE/ET/44802–T25) **Regional, residual, and derivative gravity maps of Nevada: Map 94B.** Saltus, R.W. (Geological Survey, Denver, CO (USA)). Nevada Bureau of Mines and Geology, Reno, NV (USA). 1988. 44p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AI08-78ET44802. Source: US Geological Survey, Map Distribution, Federal Center, Box 25286, Denver, CO 80225.

This packet was prepared cooperatively by the US Geological Survey. The packet contains four 1:1,000,000-scale color gravity anomaly maps of Nevada and two 1:2,500,000-scale color maps showing topography and isostatic regional gravity: (1) Bouguer gravity anomaly and topographic maps; (2) isostatic regional and residual gravity maps; (3) vertical derivative of Bouguer gravity; and (4) horizontal derivative of Bouguer gravity.

53869 (LA-UR–90-3157) **Thorium resonance ionization mass spectrometry for geochronological and geochemical applications.** Fearey, B.L.; Johnson, S.G.; Nogar, N.; Murrell, M.T.; Miller, C.M. Los Alamos National Lab., NM (USA). [1990]. 5p. Sponsored by U.S. DOE Office of Administration and Human Resource Management. DOE Contract W-7405-ENG-36. (CONF-9009174–6: 5. international symposium on resonance ionization spectroscopy and its applications, Varese (Italy), 16-21 Sep 1990). Order Number DE91000229. Source: NTIS, PC A01/MF A01 - OSTI; GPO Dep.

Resonance Ionization Mass Spectrometry (RIMS) is being developed to measure thorium isotopics from geological samples. These measurements, in conjunction with uranium measurements by thermal ionization, permit geochronological dating in the timescale of 10,000 to 350,000 years. 15 refs., 2 figs.

53870 (SAND–90-2596C) **Rare-earth arsenates and other rare-earth minerals from the Black Range Tin District, Sierra and Catron Counties, New Mexico.** Foord, E.E. (Geological Survey, Denver, CO (USA)); Hlava, P.F. Sandia National Labs., Albuquerque, NM (USA). [1990]. 3p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-9011120–1: 11. annual symposium on New Mexico minerals, Socorro, NM (USA), 10-11 Nov 1990). Order Number DE91000967. Source: NTIS, PC A01/MF A01 - OSTI; GPO Dep.

Short communication. NEW MEXICO/geochemical surveys; ARSENATES; RARE EARTH COMPOUNDS; MINERAL RESOURCES; OXIDES; VANADATES; CRYSTAL STRUCTURE; XENOTIME; ZIRCON; THORITE

53871 (UCRL–52000-90-9) **Energy and Technology Review, September 1990.** Burnham, A.K.; Johnson, K.C.; Ryerson, F.J. (eds.). Lawrence Livermore National Lab., CA (USA). 1990. 46p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. Order Number DE91001026. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This report discusses the following topics: identifying the universe's dark matter; computer simulations of cosmic ray acceleration; the interiors of uranus and neptune; seismic imaging of the deep structure of northern California; and geochemical tracing of lead contaminants in the environment.

53872 (USGS/MAP/I–1884) **Surficial geologic map of the Specter Range NW quadrangle, Nye County, Nevada.** Miscellaneous investigations series. Swadley, W.C.; Huckins, H.E. Geological Survey, Denver, CO (USA). 1989. 13p. Sponsored by

U.S. DOE Radioactive Waste Management. DOE Contract AI08-78ET44802. Source: INIS; US Geological Survey, Map Distribution, Federal Center, Box 25286, Denver, CO 80225.

The study of the surficial geology of the Specter Range NW quadrangle was undertaken in order to locate faults that displace Quaternary deposits in the Yucca Mountain region. Work was done in cooperation with the US Department of Energy, Nevada Nuclear Waste Storage Investigations Project, as part of an evaluation of a potential high-level radioactive waste repository at Yucca Mountain, approximately 35 km to the northwest. This report contains a map. 9 refs.

53873 (USGS/MAP/I–2049) **Geologic map of the Northeast quarter of the Bullfrog 15-minute quadrangle, Nye County, Nevada.** Maldonado, F.; Hausback, B.P. Geological Survey, Denver, CO (USA). [1990]. 25p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AI08-78ET44802. Source: USGS-OFR, U.S.G.S. Open File Service, Box 25425-Denver Federal Center, Denver, CO 80225.

This study of the northeast quarter of the Bullfrog 15-minute quadrangle was undertaken to determine the stratigraphy and structural setting as part of a regional study in cooperation with the US Department of Energy. Geology was mapped on aerial photographs at a scale of 1:24,000. Alluvial deposits were mapped on photographs and field checked in some cases. Outcrops of Cambrian and Proterozoic rocks in the southeast corner of the map area were taken from mapping by Monsen (1983). Thickness of units are approximate due to varying degrees of internal deformation. Identification of units is queried on the map where it is uncertain. Field terms guided by some petrographic work are used for lava flows and dikes; therefore, latite-type rocks are termed "latitic," dacite-type rocks are "dacitic," and so forth. Crystal content and amount are approximate for units younger than Tbt_6. Age determinations for the rock units have been corrected for new K-Ar constants (Dalrymple, 1979). A detachment fault (Maldonado, 1985, 1988) is defined for this study as "···a low-angle normal fault that formed at a low angle, has significant displacement, and is of subregional extent" (Reynolds and Spencer, 1985). The area was previously mapped by Ransome and others (1910) and by Cornwall and Kleinhampl (1961, 1964). A detailed discussion of the structural setting of the area is presented in a paper by Maldonado. 17 refs.

53874 (USGS-OFR–88-664) **Isostatic gravity map of the Nevada Test Site and vicinity, Nevada.** Ponce, D.A.; Harris, R.N.; Oliver, H.W. Geological Survey, Menlo Park, CA (USA). 1988. 21p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AI08-78ET44802. Source: USGS-OFR, USGS Open File Service, Box 25425-Denver Federal Center, Denver CO 80225.

The isostatic gravity map of the Nevada Test Site (NTS) and vicinity is based on about 16,000 gravity stations. Principal facts of the gravity data were listed by Harris and others (1989) and their report included descriptions of base stations, high-precision and absolute gravity stations, and data accuracy. Observed gravity values were referenced to the International Gravity Standardization Net 1971 gravity datum described by Morelli (1974) and reduced using the Geodetic Reference System 1967 formula for the normal gravity on the ellipsoid (International Union of Geodesy and Geophysics, 1971). Free-air, Bouguer, curvature, and terrain corrections for a standard reduction density of 2.67 g/cm^3 were made to compute complete Bouguer anomalies. Terrain corrections were made to a radial distance of 166.7 km from each station using a digital elevation model and a computer procedure by Plouff (1977) and, in general, include manually estimated inner-zone terrain corrections. Finally, isostatic corrections were made using a procedure by Simpson and others (1983) based on an Airy-Heiskanen model with local compensation (Heiskanen and Moritz, 1967) with an upper-crustal density of 2.67 g/cm^3, a crustal thickness of 25 km, and a density contrast between the lower-crust and upper-mantle of 0.4 g/cm^3. Isostatic corrections help remove the effects of long-wavelength anomalies related to topography and their compensating masses and, thus, enhance short- to moderate-wavelength anomalies caused by near surface geologic features. 6 refs.

53875 (USGS-OFR–89-446) **Preliminary aeromagnetic map of the Nevada Test Site and vicinity, Nevada.** Kirchoff-Stein, K.S.; Ponce, D.A.; Chuchel, B.A. Geological Survey, Menlo Park, CA (USA). 1989. 21p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AI08-78ET44802. Source: USGS-OFR, USGS Open File Service, Box 25425-Denver Federal Center, Denver, CO 80225.

As part of an effort to help geologically characterize a possible high-level nuclear waste repository at Yucca Mountain, a merged aeromagnetic map of the Nevada Test Site (NTS) and vicinity was prepared from eight separate aeromagnetic surveys. Each data set was compiled and merged by Kucks and Hildenbrand (1987) as part of a statewide aeromagnetic map of Nevada (Hildenbrand and Kucks, 1988). During processing each data set was gridded at a 1-km interval, and a geomagnetic reference field was removed. Prior to merging, each grid was either upward or downward continued to 1000 ft above the ground and datum shifts were applied, where necessary, to achieve an overall constant datum. The resulting map yields an integrated picture of the total magnetic field that is useful for identifying areas of further interest and for qualitative interpretation. However, quantitative interpretation should be made using the original data, because anomaly locations and relative amplitudes may have been altered slightly during computer processing. The final merged map was compared with the individual published maps to ensure that the location of major anomalies and magnetic trends were preserved. The average difference in anomaly positions for major anomalies is about 0.4 km, which is reasonable for a 1-km grid spacing. 13 refs.

53876 **Irreversible phase transitions and wave propagation in silicate geologic materials.** Swegle, J.W. (Department of Solid Dynamics, Sandia National Laboratories, Albuquerque, New Mexico 87185-5800 (USA)). *Journal of Applied Physics (USA)*, 68(4): 1563-1579 (15 Aug 1990). DOE Contract AC04-76DP00789.

Shock and unloading experiments on quartz and silicate rocks indicate that the release adiabats lie below the Hugoniot. The hysteresis and energy dissipation inherent in this situation have important wave propagation implications. On loading, there is a pressure-induced transition to the stishovite phase which does not occur under conditions of thermodynamic equilibrium, in that the Hugoniot passes through a metastable mixed-phase region for several tens of GPa. One interpretation of the unloading data is that the transition is not reversible, and the phase mixture remains frozen on unloading. However, material strength may also play a role. A complete thermodynamically consistent equation of state which includes phase transitions and strength effects has been developed and used to examine shock and release data on quartz and silicate rocks in order to quantify the kinetics of the reverse transition and to separate the hysteretic effects due to reverse phase transition kinetics from those due to material strength. The model allows quantitative determination of the effect of reverse transition kinetics on ground shock propagation in silicate materials.

64 PHYSICS I

6401 Astrophysics and Cosmology

Refer also to citation(s) 53577, 53871, 53996, 54057, 54080, 54244, 54269

53877 (AD-A–223985/3/XAB) **Stellar activity and brightness variations: A glimpse at the sun's history.** Radick, R.R.; Lockwood, G.W.; Baliunas, S.J. Air Force Geophysics Lab., Hanscom AFB, MA (USA). 5 Jan 1990. 8p. (GL-TR–90-0149). Source: NTIS, PC A02/MF A01.

Pub. in Science, Vol. 247, 39-44(5 Jan 1990).

Radiometric measurements during the past decade from the Solar Maximum Mission and Number 7 satellites have shown that the total solar irradiance varies in step with the sun's 11-year magnetic activity cycle. Stellar observations from the Lowell and Mount Wilson observatories now confirm and elaborate this discovery. These measurements show that older stars similar to the sun tend to become brighter as their magnetic activity level increases, just as the sun does during its 11-year activity cycle. Younger stars, however, tend to become fainter as their magnetic activity level increases. This contrasting behavior suggests that the balance between the

competing phenomena that influence solar brightness variability has shifted during the sun's lifetime.

53878 (AD-A–223986/1/XAB) **Activity, metallicity, helium, and the Hyades anomaly.** Dobson, A.K. Air Force Geophysics Lab., Hanscom AFB, MA (USA). Jan 1990. 10p. (GL-TR–90-0148). Source: NTIS, PC A02/MF A01.

Pub. in Publications of the Astronomical Society of the Pacific, Vol. 102, No. 647, 88-95(Jan 1990).

Stars in the Hyades cluster are compared with Coma cluster and main-sequence field stars to determine whether the so-called Hyades anomaly is truly a case of anomalous behavior on the part of the Hyades stars. The different in metallicity between the two clusters does not appear to account for the entire difference in the Stromgren indices. It is shown that the levels of magnetic activity do not differ between the clusters and that activity is therefore not the culprit. It is harder to account for possible differences in helium abundance,and this problem is discussed.

53879 (AD-A–223987/9/XAB) **Velocity pattern of small-scale magnetic fields.** Dara, H.C.; Alissandrakis, C.E.; Koutchmy, S. Air Force Geophysics Lab., Hanscom AFB, MA (USA). 1990. 6p. (GL-TR–90-0147). Source: NTIS, PC A02/MF A01.

High resolution observations of horizontal proper motions, as well as vertical Doppler velocities measured over two selected regions of small scale magnetic elements show a coherent behaviour. In a region with two opposite polarities, approaching with a velocity of 0.4 km/s, the material in between moves downwards with a velocity of 0.10 to 0.45 km/s; while in a region with two peaks of the same polarity, moving apart with a velocity of 0.3 km/s, the material in between moves predominantly upwards, with a velocity of up to 0.3 km/s.

53880 (AD-A–223993/7/XAB) **Optimum-filter and frame-integration application to granulation pictures.** Koutchmy, O.; Koutchmy, S. Air Force Geophysics Lab., Hanscom AFB, MA (USA). Aug 1988. 17p. (GL-TR–90-0157). Source: NTIS, PC A03/MF A01.

We consider different algorithms that aim to improve the visibility of small scale features using short-exposure-time; high-spatial-resolution solar images. The optimum or 2-D Wiener filter is first discussed. Further, an algorithm based on the application of an operator selecting maxima of convexities computed along 8 directions around each pixel is shown to be efficient for pattern recognition. Finally, a new fast reconstruction algorithm is proposed based on the use of Maxima of Fourier Magnitude deduced from a short enough time sequence of speckled power spectra; this last algorithm is shown to be very efficient in improving both the signal to noise ratio in the high frequency part of the Fourier spectrum and the Earth-atmospheric induced phase errors (destretching). Applications are given for solar granulation analysis.

53881 (AD-A–223994/5/XAB) **Simulating plumes and sinks observed at the solar surface.** Simon, G.W.; Weiss, N.O. Air Force Geophysics Lab., Hanscom AFB, MA (USA). Aug 1988. 13p. (GL-TR–90-0155). Source: NTIS, PC A03/MF A01.

Simple model of a convection plume is described with radial outflow by an analytic axisymmetric source function. It is possible to create an arbitrary pattern of cellular convection by superposing a number of sources, which may have different sizes and strengths. This method is used to simulate the large-scale horizontal flow patterns observed with the SOUP instrument on Spacelab 2. The model of superposed plumes mimics the observed motions remarkably well, especially if one include sinks in addition to sources. Passing test particles (corks) moving according to the modelled velocity field accumulate in a network pattern that coincides with the magnetic structure observed simultaneously with the SOUP observations.

53882 (AD-A–223995/2/XAB) **Coronal activity-rotation relations for lower main-sequence stars.** Dobson, A.K.; Radick, R.R. Air Force Geophysics Lab., Hanscom AFB, MA (USA). 15 Sep 1989. 9p. (GL-TR–90-0152). Source: NTIS, PC A02/MF A01.

Pub. in Astrophysical Jnl, Vol. 344, 907-914(15 Sep 1989).

The relationship between stellar soft X-ray emission and rotation has been examined using a sample of 157 lower main-sequence stars from various clusters and the field. The highest correlation between X-ray emission and rotation is found when the X-ray emission is noramlized by the bolometric emission and the rotation by the Rossby number, the rotation period divided by the convective turnover time at the base of the convective zone. No statistically significant variation of the slope of the activity-rotation relation is found with B - V color for longer period stars. The early-to-mid F stars (B - V approx. 0.3-0.45) follow the general activity-rotation relation defined by later-type stars.

53883 (AD-A–223996/0/XAB) **Line asymmetries and vertical velocities observed with a narrow-band filter.** Keil, S.L.; Bonaccini, D.; Tamblyn, P.; November, L. Air Force Geophysics Lab., Hanscom AFB, MA (USA). 1988. 16p. (GL-TR–90-0151). Source: NTIS, PC A03/MF A01.

A Fabry-Perot filter was combined with the Sacramento Peak Universal Birefringent Filter to obtain a filter system with a 20 milliangstrom band pass. Filtergrams were obtained at disk center in the Ca I line at 6162 angstroms under excellent seeing conditions. This data to measure line profiles of resolved granular features and to make maps of the vertical flow associated with the granulation. In this paper, ensemble average profiles are presented for bright granular features, dark lanes, up-flows and down-flows. The results shown here represent only a very preliminary look at the data set. A time sequence of these filtergrams is currently being processed and will allow much better separation of effects due to oscillations from those due to the granulation.

53884 (AD-A–223997/8/XAB) **Magnetoconvection on the solar surface.** Simon, G.W. Air Force Geophysics Lab., Hanscom AFB, MA (USA). 1988. 24p. (GL-TR–90-0150). Source: NTIS, PC A03/MF A01.

The solar surface is the astrophysicist's best laboratory for the study of magnetoconvection. There exists equipartition of magnetic and kinetic energy. Higher up in the thin atmosphere of the solar corona, the gas is frozen into the magnetic field lines, while below the surface the field must follow the motions of much denser ionized gas. First we give a historical review of observations of small-scale solar magnetic fields and convective flows, and then show remarkable new results obtained by seeing-free (without distortion) cinematography of the solar surface from NASA's Spacelab 2 mission. Not only is the systematic outflows from sunspots seen, but also the quiet Sun appears to be covered by convective sources, sinks, and vortices. Simultaneously-obtained magnetic field motions show excellent correlation with the gas flows. A simple kinematical model is described for these motions, and discuss briefly the implication of these data for the study of flares.

53885 (AD-A–224395/4/XAB) **Tempel 2 Dust Trail. Technical report.** Sykes, M.V.; Walker, R.G.; Lien, D.J. Steward Observatory, Tucson, AZ (USA). 28 Sep 1989. 24p. Contract F19628-87-K-0045. (SCIENTIFIC–2). Source: NTIS, PC A03/MF A01.

Observations of cometary dust at visual wavelengths are dominated by particles microns in size. At thermal wavelengths emissions from submillimeter and larger particles become important. Dust trails are phenomena which were first detected by the Infrared Astronomical Satellite (IRAS), and have been identified as large debris covering portions of the orbits of short-period comets. The Tempel 2 Dust Trail was extensively observed by the IRAS. Evidence is presented suggesting that the trail is composed of particles on the order of 1 mm and large in diameter with velocities of several meters per second relative to the parent comet, assuming isotropic emission. Trail particles forward of the comets orbital position have a minimum diameter of approx. 6 mm. These particles were emitted by the nucleus over a few hundred years. Excess color temperatures relative to a blackbody indicate that the particles either are large enough to support a temperature gradient over their surfaces or that a small particle population exists with diameters < 100A. In the case of the latter, such small particles would have to have originated from the large particles, otherwise their acceleration by the gas outflow to km/s velocities would have prevented their ejection into trail orbits.

53886 (CBPF-NF–004/90) **A classical N-Body simulation of groups of galaxies.** Pech, G.; Chung, K.C. Centro Brasileiro de Pesquisas Fisicas (CBPF), Rio de Janeiro, RJ (Brazil). 1990. 22p.

Order Number DE91605286. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

Groups of galaxies are simulated by Monte Carlo technique. The mass distribution of the groups is assumed to follow a power-law. A linear relationship between mass and luminosity is considered. (A.C.A.S.).

53887 (DOE/ER/40272–111) **Cosmic global strings.** Sikivie, P. (Florida Univ., Gainesville, FL (USA). Dept. of Physics). Florida Univ., Gainesville, FL (USA). Inst. for Fundamental Theory. [1990]. 27p. Sponsored by U.S. DOE Energy Research. DOE Contract FG05-86ER40272. (CONF-9006282–1: '90 nobel symposium: The birth and early evolution of our universe, Ostersund (Sweden), 11-16 Jun 1990). Order Number DE91000933. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

This paper discusses the following topics: Global Strings; The Gravitational field of a straight global string; How do global strings behave? The axion cosmological energy density; Computer simulations of the motion and decay of global strings; and Electromagnetic radiation from the conversion of Nambu-Goldstone bosons in astrophysical magnetic fields.

53888 (DOE/ER/40427–13-N90) **Supernova neutrinos, giant resonances, and nucleosynthesis.** Haxton, W. Washington Univ., Seattle, WA (USA). Dept. of Physics. [1990]. 10p. Sponsored by U.S. DOE Energy Research. DOE Contract FG06-88ER40427. (CONF-9005238–3: Symposium in honor of Akito Arima: nuclear physics in the 1990's, Santa Fe, NM (USA), 1-5 May 1990). Order Number DE91001148. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Almost all of the $3 \cdot 10^{53}$ ergs liberated in a core collapse supernova is radiated as neutrinos by the cooling neutron star. The neutrinos can excite nuclei in the mantle of the star by their neutral and charged current reactions. I argue that the resulting spallation reactions are an important nucleosynthesis mechanism that may be responsible for the galactic abundances of ^{7}Li, ^{11}B, ^{19}F, ^{138}La, ^{180}Ta, and approximately a dozen other light nuclei. 18 refs., 1 fig., 1 tab.

53889 (DOE/ER/40427–18-N90) **Neutrino-induced nucleosynthesis in core-collapse supernovae.** Hartmann, D.H. (Lawrence Livermore National Lab., CA (USA)); Haxton, W.C.; Hoffman, R.D.; Woosley, S.E. Washington Univ., Seattle, WA (USA). Dept. of Physics. [1990]. 6p. Sponsored by U.S. DOE Energy Research. DOE Contract FG06-88ER40427. (CONF-900601–15: 12. PANIC international conference on particles and nuclei, Cambridge, MA (USA), 24-29 Jun 1990). Order Number DE91001146. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

Almost all of the $3 \cdot 10^{53}$ ergs liberated in a core collapse supernova is radiated as neutrinos by the cooling neutron star. The neutrinos can excite nuclei in the mantle of the star by their neutral and charged current reactions. The resulting spallation reactions are an important nuleosynthesis mechanism that may be responsible for the galactic abundances of ^{7}Li, ^{11}B, ^{19}F, ^{138}La, ^{180}Ta, and number of other nuclei. 10 refs., 1 fig., 1 tab.

53890 (DOE/ER/40427–19-N90) **Neutrino induced light element synthesis.** Hartmann, D.H. (Lawrence Livermore National Lab., CA (USA)); Mathews, G.; Weaver, T.A.; Haxton, W.C.; Woosley, S.E. Washington Univ., Seattle, WA (USA). Dept. of Physics. [1990]. 3p. Sponsored by U.S. DOE Energy Research. DOE Contract FG06-88ER40427. (CONF-9006212–4: International symposium on nuclear astrophysics: nuclei in the cosmos, Vienna (Austria), 18-22 Jun 1990). Order Number DE91001144. Source: NTIS, PC A01/MF A01; OSTI; INIS; GPO Dep.

As the core of a massive star collapses to form a neutron star, the flux of neutrinos in the overlying shells of heavy elements becomes so great that, despite the small cross section, substantial nuclear transmutation is induced. Neutrinos, especially the higher energy μ- and τ-neutrinos, excite heavy elements and even helium to particle unbound levels. The evaporation of a single neutron or proton, and the back reaction of these nucleons on other species present, significantly alters the outcome of traditional nucleosynthesis calculations leading to a new process: ν-nucleosynthesis. The process was first studied by Domogatsky et al. and Woosley. Recent work by Epstein, Colgate, and Haxton and Woosley and Haxton suggested that a large number of elements could owe their existence in nature to ν-induced reactions in supernovae. A parametrized study of this process including shock wave propagation was carried out by Woosley et al. for selected zones of a 20 $M_{\odot}$ star. Here we give preliminary results for a 25 $M_{\odot}$ star, including all ν-reactions in all stellar zones.

53891 (ESA-SP–302, pp. 39-46) **Comets dirty snowballs or icy dirtballs.** Keller, H.U. (Max-Planck-Institut fuer Aeronomie, Katlenburg-Lindau (DE)). European Space Agency, 75 - Paris (France). 1989. (CONF-8910423–: Conference on physics and mechanics of cometary materials, Muenster (Germany, F.R.), 9-11 Oct 1989). In *Physics and Mechanics of Cometary Materials*. 246p. Order Number DE91709432. Source: NTIS (US Sales Only), PC A11/MF A01.

The observations of comet Halley show that the non-volatile (dust) component of the cometary nucleus has become more dominant if compared to the perception based on the icy conglomerate nucleus. The in situ observations on the Giotto spacecraft revealed an excess of large dust particles that dominate the mass distribution. Even larger particles were derived from the attitude changes of the spacrecraft bridging the gap to the cloud of particles observed by radar techniques. A dust to gas ratio larger than one was derived for comet Halley. The importance of dust for the structure of the nucleus is corroborated by the amount of particles and their lifetime in meteor streams. Fire-balls show that large (metre size) objects separate from the nucleus and are stable enough to survive hundreds of orbital periods. From the various lines of evidence it is concluded that the structure of cometary nuclei is determined by the non-volatile component rather than by ice or snow. Laboratory models based on icy agglomerations do not seem realistic as nucleus analogues.

53892 (ESA-SP–302, pp. 23-30) **Petrographic working model of the ROSETTA sampling and modelling subgroup for a comet nucleus.** Stoeffler, D. European Space Agency, 75 - Paris (France). 1989. (CONF-8910423–: Conference on physics and mechanics of cometary materials, Muenster (Germany, F.R.), 9-11 Oct 1989). In *Physics and Mechanics of Cometary Materials*. 246p. Order Number DE91709432. Source: NTIS (US Sales Only), PC A11/MF A01.

The most probable ranges of the interior and surface properties of a comet nucleus as far as they are relevant for the planning of a Comet Nucleus Sample Return Mission (ROSETTA), are documented according to the present status of discussion within the joint ROSETTA Science Working Group of ESA and NASA. On the basis of these data a comet nucleus regolith model has been developed which describes the properties of the near surface layer of a model comet nucleus at the macro- and microscale with respect to textural, compositional and geological properties. It consists of a multi-component system of fine-grained constituents forming a porous matrix and coarser grained, coherent inclusions of solid polycrystalline ice(s) rock-like aggregates.

53893 (ESA-SP–302, pp. 17-22) **Physical models of cometary nuclei: a review.** Bussoletti, E. (Istituto Universitario Navale, Naples (IT)); Schwehm, G.; Colangeli, L. European Space Agency, 75 - Paris (France). 1989. (CONF-8910423–: Conference on physics and mechanics of cometary materials, Muenster (Germany, F.R.), 9-11 Oct 1989). In *Physics and Mechanics of Cometary Materials*. 246p. Order Number DE91709432. Source: NTIS (US Sales Only), PC A11/MF A01.

In coincidence with the P/Halley's passage in 1986, in situ measurements have been performed for the first time, allowing for significant progress in comet nuclei understanding. New elaborations have been produced, although a large number of questions remains still unsolved. More work is needed to prepare a valid scientific background for future ambitious space missions - which shall return to Earth samples of cometary materials. In this paper, we will focus attention on physical structure of comets and we will discuss some of the theoretical models concerning the configuration and the evolution of a comet nucleus in combination with recent space observations and laboratory measurements.

53894 (PB–90-265166/XAB) **Catalogue of mass ejections observed by the Solar Maximum Mission coronagraph. Technical note.** St, O.C.; Burkepile, J.T. High Altitude Observatory, Boulder, CO (USA). Jul 1990. 123p. (NCAR/TN–352+STR). Source: NTIS, PC A06/MF A01.

The purpose of the publication is to provide a catalog of coronal mass ejections identified in data from the High Altitude Observatory's coronagraph aboard NASA's Solar Maximum Mission spacecraft. The list includes events observed during 1980 and between 1984 and 1989. The authors anticipate that many other investigators, including members of other SMM teams, ground-based solar observers, and interplanetary researchers, will find this list useful.

53895 (SAAO–11) **South African Astronomical Observatory.** South African Astronomical Observatory, Cape Town (South Africa). 1987. 48p. Source: Available from the South African Astronomical Observatory, PO Box 9, Observatory, 7935, South Africa.

Report for the year ending 31 December 1986.

Work at the South African Astronomical Observatory (SAAO) in recent years, by both staff and visitors, has made major contributions to the fields of astrophysics and astronomy. During 1986 the SAAO has been involved in studies of the following: galaxies; celestial x-ray sources; magellanic clouds; pulsating variables; galactic structure; binary star phenomena; nebulae and interstellar matter; stellar astrophysics; open clusters; globular clusters, and solar systems.

53896 (SAAO–11, pp. 31-33) **Solar systems.** South African Astronomical Observatory, Cape Town (South Africa). 1987. In *South African Astronomical Observatory.* 48p. Source: Available from the South African Astronomical Observatory, PO Box 9, Observatory, 7935, South Africa.

Report for the year ending 31 December 1986.

During 1986 the South African Astronomical Observatory (SAAO) was part of a collaboration that studied Halley's Comet. At SAAO, direct photographs and infrared photometry of Halley's Comet were obtained as part of a world-wide network. Various occultations of planets were also studied in 1986. 1 fig.

53897 (SAAO–11, pp. 9-11) **Ground-based observations of celestial X-ray sources.** South African Astronomical Observatory, Cape Town (South Africa). 1987. In *South African Astronomical Observatory.* 48p. Source: Available from the South African Astronomical Observatory, PO Box 9, Observatory, 7935, South Africa.

Report for the year ending 31 December 1986.

X1735-444 is among the better-studied low-mass X-ray binaries, and is one of the few for which simultaneous X-ray and optical bursts have been observed. Simultaneous observations of the X-ray burst sources X1735-444 from EXOSAT and from the South African Astronomical Observatory showed that the variations in X-ray and optical brightness were anticorrelated. Other X-ray sources studied at SAAO include: the black hole candidate GX339-4; the intermediate polar 3A0729+103 and E1013-477, and the polarimetry of ST LMi. 6 figs.

53898 (SAAO–11, pp. 11-13) **The Magellanic Clouds.** South African Astronomical Observatory, Cape Town (South Africa). 1987. In *South African Astronomical Observatory.* 48p. Source: Available from the South African Astronomical Observatory, PO Box 9, Observatory, 7935, South Africa.

Report for the year ending 31 December 1986.

It is known that mira variables in the Large Magellanic Cloud (LMC) show an infrared period-luminosity relation. The refinement of the period-luminosity relation of cepheids and miras has been advanced at the South African Astronomical Observatory (SAAO) during 1986. Studies undertaken at SAAO have included: the mira period-luminosity relation in the LMC; the young cluster NGC 1866 and its cepheids; cepheids in the Magellanic Clouds; RR Lyraes in Magellanic Cloud clusters; carbon and s-type stars in the Magellanic Clouds, and old LMC clusters. 2 figs.

53899 (SAAO–11, pp. 13-18) **Pulsating variables.** South African Astronomical Observatory, Cape Town (South Africa). 1987. In *South African Astronomical Observatory.* 48p. Source: Available from the South African Astronomical Observatory, PO Box 9, Observatory, 7935, South Africa.

Report for the year ending 31 December 1986.

A long standing problem in astrophysics is the way in which cool giant stars lose mass. This matter is of importance for the understanding of late stages of stellar evolution and for the role that this mass loss plays in the replenishment of the interstellar medium. The prime example of this mass loss phenomenon are the mira variables. A study of mass loss from mira variables was conducted at the South African Astronomical Observatory (SAAO). Other studies, involving pulsating variables, undertaken at SAAO include: miras and OH/IR sources; solar-like pulsations in stars; rapidly oscillating Ap stars; the variable star FG Sge; 53 Per stars; Be stars; Wolf-Rayet and Of stars; β Cephei stars; pulsating white dwarfs; galactic cepheids; type II cepheids; galactic clusters containing cepheids, and galactic RR Lyrae variables. 5 figs.

53900 (SAAO–11, pp. 18-21) **Galactic structure.** South African Astronomical Observatory, Cape Town (South Africa). 1987. In *South African Astronomical Observatory.* 48p. Source: Available from the South African Astronomical Observatory, PO Box 9, Observatory, 7935, South Africa.

Report for the year ending 31 December 1986.

Work at the South African Astronomical Observatory has made major contributions to understanding galactic structure in recent years. This work has included: miras and related objects in the galactic bulge; JHK mapping of the galactic centre region; south galactic cap IRAS sources; the Edinburgh-Cape Town faint blue object survey; objective-prism survey for blue stars; field faint blue stars; normal hot stars at high galactic lattidues; G dwarfs towards the south galactic pole; reddened supergiants; galactic rotation from cepheids, and galactic distance scales. 2 figs.

53901 (SAAO–11, pp. 21-25) **Binary star phenomena.** South African Astronomical Observatory, Cape Town (South Africa). 1987. In *South African Astronomical Observatory.* 48p. Source: Available from the South African Astronomical Observatory, PO Box 9, Observatory, 7935, South Africa.

Report for the year ending 31 December 1986.

Binary star phenomena were investigated by the South African Astronomical Observatory during 1986. The following were examined in detail: cataclysmic variables and related objects; eclipsing and spectroscopic binaries; calcium emission line stars; an interacting binary white dwarf system, and galactic novae. 3 figs.

53902 (SAAO–11, pp. 26-27) **Nebulae and interstellar matter.** South African Astronomical Observatory, Cape Town (South Africa). 1987. In *South African Astronomical Observatory.* 48p. Source: Available from the South African Astronomical Observatory, PO Box 9, Observatory, 7935, South Africa.

Report for the year ending 31 December 1986.

The South African Astronomical Observatory (SAAO) has investigated the IRAS source 1912+172. This source appears to be a young planetary nebula with a binary central star. During 1986 SAAO has also studied the following: hydrogen deficient planetary nebulae; high speed flows in HII regions, and the wavelength dependence of interstellar polarization. 2 figs.

53903 (SAAO–11, pp. 27-30) **Stellar astrophysics.** South African Astronomical Observatory, Cape Town (South Africa). 1987. In *South African Astronomical Observatory.* 48p. Source: Available from the South African Astronomical Observatory, PO Box 9, Observatory, 7935, South Africa.

Report for the year ending 31 December 1986.

A number of studies in the field of steller astrophysics were undertaken by the South African Astronomical Observatory in 1986. These studies included; evolutionary effects on the surface abundances of an early-type supergiant; hydrogen deficient stars; t tauri stars; rotational modulation and flares on RS CVn and BY Dra stars; carbon and heavy element stars, and slow variability and circumstellar shells of red variable stars. 4 figs.

53904 (SAAO–11, pp. 30-31) **Open clusters and associations.** South African Astronomical Observatory, Cape Town (South Africa). 1987. In *South African Astronomical Observatory.* 48p.

Source: Available from the South African Astronomical Observatory, PO Box 9, Observatory, 7935, South Africa.

Report for the year ending 31 December 1986.

Short note. STAR CLUSTERS/chemical composition; COSMIC GASES; MAIN SEQUENCE STARS; PHOTOMETRY

53905 (SAAO–11, pp. 31) **Globular clusters.** South African Astronomical Observatory, Cape Town (South Africa). 1987. In *South African Astronomical Observatory*. 48p. Source: Available from the South African Astronomical Observatory, PO Box 9, Observatory, 7935, South Africa.

Report for the year ending 31 December 1986.

Short note. STAR CLUSTERS/photometry; CHARGE-COUPLED DEVICES; GIANT STARS; METALS; SPECTROSCOPY; PHOTOMETRY

53906 (SAAO–11, pp. 5-9) **Galaxies.** South African Astronomical Observatory, Cape Town (South Africa). 1987. In *South African Astronomical Observatory*. 48p. Source: Available from the South African Astronomical Observatory, PO Box 9, Observatory, 7935, South Africa.

Report for the year ending 31 December 1986.

The size and nature of any large-scale anisotropy in the three-dimensional distribution of galaxies is still little understood. Recent studies have indicated that large fluctuations in the matter distribution on a scale from tens up to several hundreds of megaparsecs may exist. Work at the South African Astronomical Observatory (SAAO) in recent years has made major contributions to studies of the large scale distribution of galaxies, as well as to solving the problems of the galactic and extragalactic distance scale. Other studies of galaxies undertaken at SAAO include: quasars in the fields of nearby galaxies; dwarf irregular galaxies; IRAS galaxies; Seyfert galaxies; 'hot spot' galaxies; supernovae in NGC 5128 and NGC 1559 and superclusters. 4 figs.

53907 (UCRL-JC–106057) **Analysis of gamma ray burst spectra with cyclotron lines.** Kargatis, V. (Rice Univ., Houston, TX (USA). Dept. of Space Physics and Astronomy); Liang, E.P. Lawrence Livermore National Lab., CA (USA). 26 Sep 1990. 8p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-9007101–1: Los Alamos workshop on gamma-ray bursts, Taos, NM (USA), 29 Jul - 3 aug 1990). Order Number DE91001745. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Motivated by the recent developments in the cyclotron resonance upscattering of soft photons or CUSP model of Gamma Ray Burst (GRB) continuum spectra, we revisit a select database of GRBs with credible cyclotron absorption features. We measure the break energy of the continuum, the slope below the break and deduce the soft photon energy or the electron beam Lorentz factor cutoff. We study the correlation (or lack of) between various parameters in the context of the CUSP model. One surprise result is that there appears to be marginal correlation between the break energy and the spectral index below the break. 20 refs., 8 figs., 2 tabs.

53908 **A 190 second periodicity in the optical emission of the enigmatic X-ray source GX 339-4.** Steiman-Cameron, T. (NASA, Ames Research Center, Moffett Field, CA (USA)); Imamura, J.; Middleditch, J.; Kristian, J. *Astrophysical Journal (USA)*, 359: 197-203 (Aug 1990).

The results are reported of submillisecond white-light optical photometry of the X-ray source GX 339-4 obtained over the years 1985-1988 at the Las Campanas Observatory and Cerro Tololo Inter-American Observatory. A coherent, dI/I less than 0.025, 5.25 mHz feature with pulsed amplitude up to 50 percent is found which persisted for about 20-30 cycles. The feature only appeared in data taken in July 5, 1986 UT. The 885 Hz feature proposed by Imamura et al. (1990) was not detected at 90-percent-confidence upper limits of 2 percent pulsed emission. The 885 Hz feature was reported by Imamura et al. to have a pulsed amplitude of 2.3-2.4 percent. The proposed 0.2 mag, 0.618 day orbital variation proposed by Honey et al. (1988) could not be verified due to the length of the data strings. 24 refs.

53909 **Neutrino properties and supernova SN1987a.** Nussinov, S. (California Univ., Los Angeles (USA)). *Annals of the New York Academy of Sciences (USA)*, 578: 131-137 (Dec 1989). (CONF-8902110–: 2. international symposium on the fourth family of quarks and leptons, Santa Monica, CA (USA), 23-25 Feb 1989).

The use of SN1987a to indicate how limits on neutrino properties can be deduced from the observed neutrino signals is shown. Bounds on possible deviations from relativity are briefly considered. The possible evidence for a half-millisecond pulsar in the SN remnant and on speculative attempts at finding the same periodicity in the neutrino signal are commented on. 37 refs.

53910 **Dark matter and solar neutrino problem - Can particle physics provide a single solution?.** West, G.B. (California Univ., Los Angeles (USA)). *Annals of the New York Academy of Sciences (USA)*, 578: 469-478 (Dec 1989). (CONF-8902110–: 2. international symposium on the fourth family of quarks and leptons, Santa Monica, CA (USA), 23-25 Feb 1989).

The idea of the cosmion is reviewed, and the possibility that it can resolve both the dark matter problem and the solar neutrino problem is addressed. It is shown that a new stable neutral lepton with a mass in the 4-8 GeV range is required to obtain such a solution. One possibility is a fourth-generation neutrino interacting with matter either electromagnetically or via Higgs exchange. 29 refs.

53911 **Cosmic gamma-ray bursts - An overview of recent results.** Hurley, K. (Texas Univ., Richardson (USA)). *Annals of the New York Academy of Sciences (USA)*, 571: 442-459 (1989). (CONF-881268–: 14. Texas symposium on relativistic astrophysics, Dallas, TX (USA), 11-16 Dec 1988).

The essential aspects of the cosmic gamma-ray burst (GRB) phenomenon are reviewed with emphasis of recent results. In particular, the energy spectra of GRBs are presented to demonstrate that the origin of some GRBs involves neutron stars. Counterpart searches are briefly reviewed, and the statistical properties of bursters are discussed. Finally, attention is given to extragalactic and Galactic GRB models and to the assessment of future prospects. 72 refs.

53912 **Cyclotron resonant scattering in the spectra of gamma-ray bursts.** Lamb, D.Q. (Texas Univ., Richardson (USA)); Wang, J.C.L.; Loredo, T.J.; Wasserman, I.; Fenimore, E.E. *Annals of the New York Academy of Sciences (USA)*, 571: 460-481 (1989). (CONF-881268–: 14. Texas symposium on relativistic astrophysics, Dallas, TX (USA), 11-16 Dec 1988).

Data on the GB880205 gamma-ray bursts are presented that have implications for the nature of gamma-ray burst sources. It is shown that cyclotron resonant scattering and Raman scattering account well for the positions, strengths, and shapes of the relative strengths of the first and second harmonics and their narrow widths. These results imply the existence of a superstrong (B of about 2 x 10 to the 12th G) magnetic field in the vicinity of the X-ray emission region of GB880205. Such a superstrong magnetic field points to a strongly magnetic neutron star as the origin of gamma-ray bursts, and to the fact that the gamma-ray sources belong to the Galaxy. 59 refs.

53913 **The Fourth family of quarks and leptons; Proceedings of the Second International Symposium, Santa Monica, CA, Feb. 23-25, 1989.** Cline, D.B.; Soni, A. *Annals of the New York Academy of Sciences (USA)*, 578: 506 (Dec 1989). (CONF-8902110–: 2. international symposium on the fourth family of quarks and leptons, Santa Monica, CA (USA), 23-25 Feb 1989).

Various papers on quarks and leptons are presented. Among the individual topics addressed are: properties of neutrinos from neutron astronomy, limits on fourth family neutrinos from searches for beta-beta decay and quark matter, neutrino properties and supernova SN 1987a, nucleosynthesis constraints on the number of neutrino flavors, searching for halo dark matter through gamma-ray lines, and dark matter and the solar neutrino problem.

53914 **Possible gravitational collapse into a black hole of the pulsar in Supernova 1987A.** Glendenning, N.K. (Lawrence Berkeley Lab., CA (USA). Nuclear Science Div.). *Modern Physics Letters A (USA)*, 5(10): 713-717 (20 Apr 1990). DOE Contract AC03-76SF00098.

The authors discuss how recapture of an object from debris spewed at the early stage of formation by the millisecond pulsar

whose signals where observed briefly in the remnant of SN1987A may have caused its subsequent collapse into a black hole, by damping the rapid rotation which is believed to have contributed to it stability. The mass of the object sufficient to bring this about in the two week interval between observation and next search is calculated to be up to 1/20 of a Jupiter mass.

53915 **Cosmic ray evidence for physics beyond the Standard Model.** Domokos, G. (Johns Hopkins Univ., Baltimore, MD (USA). Dept. of Physics and Astronomy); Kovesi-Domokos, S. *Modern Physics Letters A (USA)*, 5(10): 705-712 (20 Apr 1990).

Ultra high energy observational data collected during the last decade indicate an anomalous interaction of the particles emitted by some point sources in the sky. The authors review the evidence and discuss possible explanations of the observed anomalies. The most likely interpretation is that at energies of the order of a few TeV in the center of mass, new phenomena begin to take place which cannot be explained within the framework of the Standard Model. Implications of such an explanation are discussed.

53916 **Monopole accretion by cosmic strings.** Matheson, A.M. (Brown Univ., Providence, RI (USA). Dept. of Physics); Upton, D.M. *Modern Physics Letters A (USA)*, 5(17): 1313-1320 (20 Jul 1990).

The authors study the accretion of super-heavy magnetic monopoles, around cosmic string loops in the very early universe. For sufficiently massive monopoles, a possible result of this accretion process is the formation of monopole-black holes, leading ultimately to monopole-to-photon ratio comparable to the limits required by neutron star observations.

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Refer also to citation(s) 54269

53917 (AD-A–224270/9/XAB) **Geophysical alert broadcast user's guide. Final report.** Rosenthal, D.A. Naval Weapons Center, China Lake, CA (USA). Mar 1989. 25p. (NWC-TP–6981). Source: NTIS, PC A03/MF A01.

Errata sheet inserted.

This guide presents an overview of the National Oceanic and Atmospheric Administration's (NOAA) hourly short-wave radio bulletins, which provide constantly updated information on solar-activity-induced effects on the near-earth space environment.

53918 (AD-A–224391/3/XAB) **Satellite measurements of Magnetospheric Poynting flux. Final report, August 1988-March 1990.** Vickrey, J.F.; Kelley, M.C.; Knudsen, D.J. SRI International, Menlo Park, CA (USA). 9 Mar 1990. 35p. Contract F19628-86-K-0044. Source: NTIS, PC A03/MF A01.

The first satellite observations of the Magnetospheric Poynting flux are presented for two presented for two passes of the HILAT satellite over the northern polar regions. The simultaneously measured energy input due to precipitating particles is also presented. The Poynting flux is in general agreement with an independent estimate of the Joule dissipation in the upper atmosphere. However, there are localized regions in both orbits of net upward Poynting flux, suggesting a neutral wind dynamo. Evidence for the existence of propagating Alfven waves as well as steady state current systems closed in the ionosphere are also presented.

53919 (AD-A–224392/1/XAB) **Assessment of the application of in situ ion-density data from DMSP to modeling of transionospheric scintillation. Final report, 15 September 1989-14 March 1990.** Secan, J.A.; Reinleitner, L.A.; Bussey, R.M. Northwest Research Associates, Inc., Bellevue, WA (USA). 15 Mar 1990. 33p. Contract F19628-86-C-0195. (NWRA-CR–90-R060). Source: NTIS, PC A03/MF A01.

Modern military communication, navigation, and surveillance systems depend on reliable, noise-free transionospheric radio-frequency channels. They can be severely impacted by small-scale electron-density irregularities in the ionosphere, which cause both phase and amplitude scintillation. Basic tools used in planning and mitigation schemes are climatological in nature and thus may greatly over- and under-estimate the effects of scintillation in a given scenario. This report summarizes the results of a three-year investigation into the feasibility of using in-situ observations of the ionosphere from the USAF DMSP satellite to calculate estimates of irregularity parameters that could be used to update scintillation models in near real-time. Estimates for the level of intensity and phase scintillation on a transionospheric UHF radio link in the early-evening auroral zone were calculated from DMSP Scintillation Meter (SM) data and compared to the levels actually observed. The intensity scintillation levels predicted and observed compared quite well, but the comparison with the phase scintillation data was complicated by low-frequency phase noise on the UHF radio link. Results are presented from analysis of DMSP SSIES data collected near Kwajalein Island in conjunction with a propagation-effects experiment. Preliminary conclusions to the assessment study are: (1) the DMSP SM data can be used to make quantitative estimates of the level of scintillation at auroral latitudes, and (2) it may be possible to use the data as a qualitative indicator of scintillation-activity levels at equatorial latitudes.

53920 (AD-A–224393/9/XAB) **Effects of energy, momentum, and particle transport in the near-earth solar-terrestrial system. Final report, 2 December 1986-1 May 1990.** Anderson, P.B.; Basinska-Lewin, E.M.; Greenspan, M.E.; James, J.H.; Weimer, D.R. Regis Coll., Weston, MA (USA). Research Center. 1 Jun 1990. 83p. Contract F19628-86-K-0045. Source: NTIS, PC A05/MF A01.

This work has included the scientific studies of high-latitude plasma irregularities and the physics of the aurora, engineering of space environmental sensors, and data processing services. Scientific studies were conducted in the areas of energy dissipation, magnetosphere-ionosphere interactions and ionospheric plasma. Design work has been done on a series of plasma instruments for the Defense Meteorological Satellite Program (DMSP), the Combined Release and Radiation Effects Studies (CRRES), the Photovoltaic Array Space Power (PASP), the Interactions Measurements Payload for Shuttle (IMPS) and the NASA POLAR satellite program. Computer programs have been written to process RPA and Drift Meter data from the F8 and F9 DMSP satellites.

53921 (AD-A–224396/2/XAB) **Intersystem collisional transfer of excitation in the mesosphere and in the laboratory. Final report, 3 November 1983-31 December 1986.** Benesch, W.; Carragher, B.; Morrill, J. Maryland Univ., College Park, MD (USA). Inst. for Physical Science and Technology. Mar 1987. 293p. Contract F19628-84-K-0017. Source: NTIS, PC A13/MF A02.

The report describes a program of experimentation involving the emission spectra of auroral species and the processes and mechanisms leading to the production of their spectra. Emphasis is on the temporal evolution of the spectrum, particularly as brought about by the intersystem collisional transfer of excitation. This latter process becomes important in auroral spectra at or near mesospheric altitudes where the collision frequency becomes comparable with the transition probability from the excited state of the auroral emitter. The experiments have been undertaken in several modes, but in every case the observational technique is that of time-resolved spectroscopy by means of which we are able to detect changes in the emitted spectrum of a collision-by-collision basis. Previously unreported effects are described which fall in the category of molecular excitation energy storage and release. Examples are given of possible superradiance where particular vibrational levels of molecular nitrogen become temporarily overpopulated with respect to those in adjacent electronic states.

53922 (AD-A–224397/0/XAB) **Investigation of structure and transport processes in the high-latitude ionospheric plasma using ground based and airborne digisondes. Final report, 8 August 1986-7 December 1989.** Reinisch, B.W.; Bibl, K.; Bullett, T.W.; Cannon, P.S.; Crowley, G. Lowell Univ., MA (USA). Center for Atmospheric Research. Jan 1990. 173p. Contract F19628-86-K-0036. (ULRF–455/CAR). Source: NTIS, PC A08/MF A01.

The Digisonde 256 an advanced ionospheric sounder is a new and exciting tool for obtaining important ionospheric information. Like a conventional ionosonde, the Digisonde yields vertical electron density profiles. However, the antenna arrangement and sophisticated data handling system also permits plasma drift velocities to be derived from the ionospheric reflections. The F-region plasma drifts perpendicular to the magnetic field at the E x B velocity, and electric fields can therefore be deduced from the Digisonde

drift measurements. This final report describes the development of the drift analysis techniques and highlights some of the exciting scientific results obtained by the Air Force Digisonde network, including the Airborne Ionospheric Observatory (AIO) of the Geophysics Laboratory. Digisonde data have been applied to the study of large scale ionospheric features such as high latitude convection, polar cap patches, sun aligned arcs and the midlatitude trough.

53923 (AD-A-224402/8/XAB) **High-power oblique incidence h-f ionospheric modification. Report for 25 February 1987-25 February 1988.** Sales, G.S.; Platt, I.G. Lowell Univ., MA (USA). Center for Atmospheric Research. Apr 1990. 48p. Contract F19628-87-K-0012. (ULRF-456/CAR). Source: NTIS, PC A03/MF A01.

To successfully perform the proposed ionospheric modification experiment (IONMOD) it is necessary to establish the range of the expected changes in the ionosphere, the parameters that offer the greatest likelihood of detection of these changes and the systems that can best carry out the appropriate measurements to detect them. The distributed region of the ionosphere is modeled as a spherical depletion region of varying depth and size. Three dimensional numerical ray tracing is then used to determine the expected magnitude and location of the amplitude and arrival angle deviations. These calculations indicate rather small changes, of the order of 3 dB in amplitude and about 0.5 deg in the elevation angle, with even smaller changes in the azimuth arrival angle. This leads to strong requirements for the measuring system in terms of antenna design and the signal to noise that must be achieved. Consider the basic concept of a probe system to make the required amplitude and arrival angle measurements. Such a system will be based upon the real time calculation of the Doppler spectrum of the signal on each antenna of the system and use the measured phase difference on each line in the spectrum, as an interferometer, to determine the arrival angle and amplitude. The requirements are determined for the signal to noise ration that will permit the measurements with sufficient accuracy. The results indicate that sufficient measurement sensitivity of the probe system can be achieved with a transmitter power of 100 W continuous and an antenna pre-amplifier (with a low noise front end) properly designed to be atmospherically noise limited.

53924 **Solar wind monitor satellite.** Kappenman, J.G. (Minnesota Power, MN (US)); Albertson, V.D.; Damsk, B.L.; Dale, S.J. *IEEE Power Engineering Review (USA),* : 4-7 (May 1990).

This authors discuss the effects of geomagnetic disturbances on power systems. They also discuss the effects of geomagnetic storms on spacecraft electronics, pipelines, and geophysical surveys for oil and minerals. The current satellite system technology used in geomagnetic disturbance forecasts is described and assessed.

53925 **Fractal boundaries in magnetotail particle dynamics.** Chen, J. (Naval Research Lab., Washington, DC (USA)); Rexford, J.L.; Lee, Y.C. *Geophysical Research Letters (American Geophysical Union) (USA),* 17(8): 1049-1052 (Jul 1990).

It has been recently established that particle dynamics in the magnetotail geometry can be described as a nonintegrable Hamiltonian system with well-defined entry and exit regions through which stochastic orbits can enter and exit the system after repeatedly crossing the equatorial plane. It is shown that the phase space regions occupied by orbits of different numbers of equatorial crossings or different exit modes are separated by fractal boundaries. The fractal boundaries in an entry region for stochastic orbits are examined and the capacity dimension is determined.

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Refer also to citation(s) 53097, 53137, 53237, 53238, 53239, 53240, 53241, 53268, 53270, 53279, 53320, 53322, 53324, 53325, 53326, 53327, 53328, 53330, 53337, 53338, 53368, 53374, 53456, 53459, 53460, 53461, 53462, 53464, 53465, 53467, 53468, 53469, 53470, 53476, 53477, 53478, 53480, 53549, 53571, 54167, 54169, 54193, 54195, 54196, 54227, 54279, 54285, 54286, 54287, 54288, 54291, 54292, 54293, 54295, 54296, 54316, 54324, 54326, 54327, 54328, 54329, 54331, 54332, 54333, 54334, 54335, 54341, 54343, 54368, 54385

53926 (BNL-45214) **High pressure effects on the properties and reactions of excess electrons in hydrocarbons.** Holroyd, R. (Brookhaven National Lab., Upton, NY (USA)); Nishikawa, Masaru. Brookhaven National Lab., Upton, NY (USA). [1990]. 6p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. (CONF-9009263-1: 5. working meeting on radioactive interactions, Leipzig (Germany, F.R.), 24-28 Sep 1990). Order Number DE91000578. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

These studies, utilizing high pressure, have provided considerable insight into the mechanism of electron transport and electron reactions in hydrocarbon liquids. Electrostriction leads to a significant negative volume change (about -20 cm^3/mol) for electron trapping in alkanes. Electrostriction around an ion is even greater (-100 to -200 cm^3/mol). This effect and the fact that the energy level of the electron increases with pressure both contribute to shifts in electron attachment equilibria to favor ions at high pressure. Considerable effort has gone into studies of the mobility, properties and reactions of electrons in nonpolar liquids at or near normal pressures. Only recently have studies been undertaken of the effect of high pressure (up to 3 kbar) on electron behavior in such liquids. Pressures of this magnitude change the electron mobility in both alkane and aromatic liquids, and affect the ground state energy of electrons and stability of ions, which cause changes in the rates of electron reactions. 19 refs., 2 figs., 2 tabs.

53927 (CBPF-MO-001/89, pp. 21-62) **Electrostatic properties of nucleic acids: some theoretical aspects.** Oliveira Neto, M. de (Brasilia Univ., DF (Brazil). Dept. de Quimica). Centro Brasileiro de Pesquisas Fisicas (CBPF), Rio de Janeiro, RJ (Brazil). 1988. (In Portuguese). (CONF-8809499-: 6. Latin American School on Theoretical Chemistry, Rio de Janeiro (Brazil), 11-17 Sep 1988). In *Proceedings of 6. Latin American School on Theoretical Chemistry. v. 2 pt. 2.* 190p. Source: Available from the Library of the Comissao Nacional de Energia Nuclear, RJ, Brazil.

In this work, two theoretical approaches of the applications of quantum chemistry to biological macromolecules are presented: one with the intent of evaluating the interaction of this sistem to electrophilic compounds, and the other concerning the interaction of biological substrates to water molecules. (A.C.A.S.).

53928 (CBPF-MO-001/89, pp. 98-154) **Discretization of the continuum spectra using L^2 basis sets.** Nascimento, M.A.C. (Universidade Federal, Rio de Janeiro, RJ (Brazil). Dept. de Fisico-Quimica). Centro Brasileiro de Pesquisas Fisicas (CBPF), Rio de Janeiro, RJ (Brazil). 1988. (CONF-8809499-: 6. Latin American School on Theoretical Chemistry, Rio de Janeiro (Brazil), 11-17 Sep 1988). In *Proceedings of 6. Latin American School on Theoretical Chemistry. v. 2 pt. 2.* 190p. Source: Available from the Library of the Comissao Nacional de Energia Nuclear, RJ, Brazil.

A brief discussion on the basis set problem associated to bound states calculations is presented. The possibility of a discrete-basis-set representation of the continuum states of atoms and molecules is discussed and a criterium to select an adequate L^2 basis to represent the continuum is presented. (A.C.A.S.).

53929 (CBPF-MO-001/89, pp. 1-20) **The Monte Carlo method and its applications in the studies of chemical processes in solution.** Oliveira Neto, M. de (Brasilia Univ., DF (Brazil). Dept. de Quimica). Centro Brasileiro de Pesquisas Fisicas (CBPF), Rio de Janeiro, RJ (Brazil). 1988. (In Portuguese). (CONF-8809499-: 6. Latin American School on Theoretical Chemistry, Rio de Janeiro (Brazil), 11-17 Sep 1988). In *Proceedings of 6. Latin American School on Theoretical Chemistry. v. 2 pt. 2.* 190p. Source: Available from the Library of the Comissao Nacional de Energia Nuclear, RJ, Brazil.

The Monte Carlo method is resumed and presented with special emphasis on its use in the calculations for obtaining the variation of the free energy in chemical processes. (A.C.A.S.).

53930 (CBPF-MO-001/89, pp. 155-181) **Comments on the theoretical and computational aspects in correlated methods: configuration, interaction, many-body perturbation theory and coupled-cluster.** Canuto, S. (Pernambuco Univ., Recife, PE (Brazil). Dept. de Fisica). Centro Brasileiro de Pesquisas Fisicas (CBPF), Rio de Janeiro, RJ (Brazil). 1988. (In Portuguese).

(CONF-8809499–: 6. Latin American School on Theoretical Chemistry, Rio de Janeiro (Brazil), 11-17 Sep 1988). In *Proceedings of 6. Latin American School on Theoretical Chemistry. v. 2 pt. 2.* 190p. Source: Available from the Library of the Comissao Nacional de Energia Nuclear, RJ, Brazil.

Theoretical and computational aspects in correlated methods are discussed such as: configuration interaction, many body perturbation theory and coupled-cluster. (A.C.A.S.).

53931 (CNIC–00303) **Magic numbers and isotopic effect of ion clusters.** Wang Guanghou (Nanjing Univ., JS (China). Dept. of Physics). China Nuclear Information Centre, Beijing, BJ (China). Apr 1989. 22p. (In Chinese, English). (NU–0004). Order Number DE91604985. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

The magic numbers and isotopic effect as well as stable configurations in relation to the charge state of the clusters are discussed. Ionic (atomic) clusters are small atomic aggregates, a physical state between gas and solid states, and have many interesting properties, some of them are more or less similar to those in nuclei.

53932 (CONF-901116–13) **Angular distributions of single- and double-electron capture in very-slow Ar^{6+}-Ar collisions.** Biedermann, C. (Tennessee Univ., Knoxville, TN (USA). Dept. of Physics); Levin, J.C.; Short, R.T.; Elston, S.B.; Gibbons, J.P.; Kimura, K.; Keller, N.; Sellin, I.A.; Cederquist, H.; Andersson, L.R.; Andersson, H.; Liljeby, L. Oak Ridge National Lab., TN (USA). [1990]. 14p. Sponsored by U.S. DOE Energy Research; National Science Foundation; Swedish National Science Research Council. DOE Contract AC05-84OR21400. From 11. international conference on the application of accelerators in research and industry; Denton, TX (USA); 5-8 Nov 1990. Order Number DE91001217. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

We have measured state-resolved angular distributions of one- and two-electron capture in 32 to 800 eV Ar^{6+} – Ar collisions. The experimental energy-gain spectra show that single-electron capture mainly populates the 5s, 5p and 4f levels. We observe detailed structures in the corresponding angular distributions, but a final interpretation has to await a quantitative analysis of the collision dynamics. We tentatively ascribe the main features in the angular distribution of true double-electron capture at Q ~ 26 eV (4s4f and 4s5s) and Q ~ 42 eV (3d4d) to processes involving two consecutive one-electron transitions. For the transfer ionization process, we measure a Q-value of ~eV, which we assign to autoionizing 4s5s (or 4s4f) levels. The 4s5s, 4s4f, and 3d4d levels all reside above the first ionization limit of Ar^{4+}, but we find that the 3d4d level stabilizes through radiative decay. 8 refs., 4 figs.

53933 (CONF-901116–14) **Photoion Auger-electron coincidence measurements near threshold.** Levin, J.C. (Tennessee Univ., Knoxville, TN (USA). Dept. of Physics); Biedermann, C.; Keller, N.; Liljeby, L.; Short, R.T.; Sellin, I.A.; Lindle, D.W. Oak Ridge National Lab., TN (USA). [1990]. 15p. Sponsored by U.S. DOE Energy Research; National Science Foundation. DOE Contract AC05-84OR21400 ;AC02-76CH00016. From 11. international conference on the application of accelerators in research and industry; Denton, TX (USA); 5-8 Nov 1990. Order Number DE91001211. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The vacancy cascade which fills an atomic inner-shell hole is a complex process which can proceed by a variety of paths, often resulting in a broad distribution of photoion charge states. We have measured simplified argon photoion charge distributions by requiring a coincidence with a K-LL or K-LM Auger electron, following K excitation with synchrotron radiation, as a function of photon energy, and report here in detail the argon charge distributions coincident with $K\text{-}L_1L_{23}$ Auger electrons. The distributions exhibit a much more pronounced photon-energy dependence than do the more complicated non-coincident spectra. Resonant excitation of the K electron to np levels, shakeoff of these np electrons by subsequent decay processes, double-Auger decay, and recapture of the K photoelectron through postcollision interaction occur with significant probability. 17 refs.

53934 (CONF-901116–15) **Electron capture by multicharged ions from hydrogen atoms at eV energies.** Havener, C.C.; Nesnidal, M.P.; Porter, M.R.; Phaneuf, R.A. Oak Ridge National Lab., TN (USA). [1990]. 12p. Sponsored by U.S. DOE Energy Research; Great Lakes Colleges Association/Associated Colleges of the Midwest; University of Tennessee. DOE Contract AC05-84OR21400. From 11. international conference on the application of accelerators in research and industry; Denton, TX (USA); 5-8 Nov 1990. Order Number DE91001214. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

To quantitatively study electron capture during collisions of multiply charged ions with neutral atoms at near-thermal energies, keV-energy multicharged ion beams are merged with ground-state beams of H or D atoms of chosen velocity such that collisions in the relative energy range 1–1000 eV/amu result. Recent data for O^{3+}, O^{4+} + H(D) are presented and compared with theoretical predictions. Recently completed modifications to the apparatus are described that will provide a significant improvement in signal-to-background and angular collection. These improvements will allow measurements to be extended to lower energies, where effects due to the ion-induced dipole attraction may be evident.

53935 (CONF-901116–17) **Coulomb "path" interference in low energy He^+ + He collisions.** Swenson, J.K. (Lawrence Livermore National Lab., CA (USA)); Burgdoerfer, J.; Meyer, F.W.; Havener, C.C.; Gregory, D.C.; Stolterfoht, N. Oak Ridge National Lab., TN (USA). [1990]. 14p. Sponsored by U.S. DOE Energy Research; National Science Foundation. DOE Contract AC05-84OR21400 ;W-7405-ENG-48. From 11. international conference on the application of accelerators in research and industry; Denton, TX (USA); 5-8 Nov 1990. Order Number DE91001628. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

A new interference mechanism, analogous to "classic" double-slit electron scattering, has been identified in low energy ion-atom collisions. This Coulomb "path" interference results from the existence of two trajectories, indistinguishable with respect to laboratory energy and emission angle, along which ejected autoionizing electrons may be scattered by the attractive Coulomb potential of the slowly receding spectator ion. We present a simple semi-classical model for this effect in which we account for the path dependence of the amplitude of the ejected electron following decay of the autoionizing state. Calculated model lineshapes are found to be in excellent agreement with strong angular dependence of the interference structure observed in the He target $2s^2\ ^1S$ autoionizing lineshape measured near 0° following 10 keV He^+ + He collisions.

53936 (CTA-IEAv-RP–013/86) **Correlations between observables in N-D scattering.** Frederico, T. (Centro Tecnico Aeroespacial (CTA-IEAv), Sao Paulo, SP (Brazil). Inst. de Estudos Avancados); Goldman, I.D. Centro Tecnico Aeroespacial (CTA-IEAv), Sao Jose dos Campos, SP (Brazil). Inst. de Estudos Avancados. Apr 1986. 12p. Order Number DE91605006. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

We have found that in neutrn-deuteron scattering the correlation of Kcot $^2\delta_o$ with the doublet scattering length (^{2}a) is roughly linear for energies above the threshold. We predict the value of Kcot $^2\delta_o$ for the correct ^{2}a at the energies of 5.6MeV and 9.4MeV. Our calculations reproduce the p-d experimental data of Arvieux, but are in disagreement with the experimental n-d $^2\delta_o$ data of Van Oers and Seagrave. (author).

53937 (CTA-IEAv-RP–031/88) **A theoretical determination of the dipole moment function and spectroscopic properties of the BeF molecule in the $X^2\Sigma^+$ state.** Machado, F.B.C.; Ornellas, F.R. Centro Tecnico Aeroespacial (CTA-IEAv), Sao Jose dos Campos, SP (Brazil). Inst. de Estudos Avancados. Oct 1988. 20p. Order Number DE91605007. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

A dipole moment function and vibrationally averaged dipole moments, radiative transition probabilities and radiative lifetimes for several vibrational levels and selected rotational levels of the BeF molecule in the $X^2\Sigma^+$ state are reported together with the corresponding spectroscopic constants calculated by standard fitting procedures. (author).

53938 (CTA-IEAv-RP–032/88) **A multi-reference singles and doubles configuration interaction determination in the dissociation energy and vibrational levels of the BeF molecules in the $X^2\Sigma^+$ state.** Machado, F.B.C.; Ornellas, F.R. Centro Tecnico

Aeroespacial (CTA-IEAv), Sao Jose dos Campos, SP (Brazil). Inst. de Estudos Avancados. Oct 1988. 18p. Order Number DE91605008. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

An accurate potential energy curve for the BeF molecule in the $X^2\Sigma^+$ state is calculated within the MRSDCI approach. Vibrational level spacings and the dissociation energy are reported. Agreement with the available experimental spacings is 15 cm^{-1} on the average. The theoretically computed D_e, 5.92 eV, favors the experimental value of 5.85 eV over the higher value of 6.26 eV. Arguments are also presented that show why the value obtained by the Birge-Sponer linear extrapolation is accidentally a good one. (author).

53939 (DOE/ER/13867–8) **Theoretical studies of atomic transitions: Progress report, April 1, 1990–March 31, 1991.** Fischer, C.F. Vanderbilt Univ., Nashville, TN (USA). Oct 1990. 7p. Sponsored by U.S. DOE Energy Research. DOE Contract FG05-88ER13867. Order Number DE91000931. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

This paper discusses: lifetime of excited states; core-polarization studies; large relativistic calculations; Monte Carlo Hartree-Fock (MCHF) atomic structure package; and MCHF codes for the hypercube. (LSP)

53940 (DOE/ER/13874–3) **Negative ion detachment processes: Progress report, April 1, 1988–March 31, 1991.** Champion, R.L.; Doverspike, L.D. College of William and Mary, Williamsburg, VA (USA). Dept. of Physics. Oct 1990. 12p. Sponsored by U.S. DOE Energy Research. DOE Contract FG05-88ER13874. Order Number DE91001218. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

This paper discusses the following topics: H^- and D^- collisions with atomic hydrogen; collisional decomposition of SF_6^-; two-electron loss processes in negative ion collisions; associative electron detachment; and negative ion desorption from surfaces.

53941 (GANIL-P–8917) **Light particle emission as a probe of reaction mechanism and nuclear excitation.** Guerreau, D. Grand Accelerateur National d'Ions Lourds (GANIL), 14 - Caen (France). 1989. 38p. (CONF-8907154–: Enrico Fermi summer course CX11: nuclear collisions from the mean field into the fragmentation regime, Varenna (Italy), 11-21 Jul 1989). Order Number DE91716319. Source: NTIS (US Sales Only), PC A03/MF A01.

The central part of these lectures will be dealing with the problem of energy dissipation. A good understanding of the mechanisms for the dissipation requires to study both peripheral and central collisions or, in other words, to look at the impact paramenter dependence. This should also provide valuable information on the time scale. In order to probe the reaction mechanism and nuclear excitation, one of the most powerful tool is unquestionably the observation of light particle emission, including neutrons and charged particles. Several examples will be discussed related to peripheral collisions (the fate of transfer reactions, the excitation energy generation, the production of projectile-like fragments) as well as inner collisions for which extensive studies have demonstrated the strength of intermediate energy heavy ions for the production of very hot nuclei and detailed study of their decay properties.

53942 (GSI–90-11) **Positron spectroscopy after heavy ion collisions.** Bokemeyer, H. Gesellschaft fuer Schwerionenforschung mbH, Darmstadt (Germany, F.R.); Frankfurt Univ. (Germany, F.R.). Fachbereich 13 - Physik. May 1990. 220p. (In German). Order Number DE91717338. Source: NTIS (US Sales Only), PC A10/MF A01.

The author reviews the theoretical and experimental results on positron production in heavy ion collisions. After a discussion of the quasi-atomic picture, the possible observation of the axion, and the inverse Bhabha scattering, the positron spectrometer EPOS of the GSI Darmstadt is described. Thereafter the experimental results are presented. (HSI).

53943 (GSI–90-12) **Studies of the emission of δ electrons in binary heavy-ion collisions at the Coulomb barrier.** Mojumder, S. Gesellschaft fuer Schwerionenforschung mbH, Darmstadt (Germany, F.R.); Frankfurt Univ. (Germany, F.R.). Inst. fuer Kernphysik. Jun 1990. 119p. (In German). Order Number DE91717339. Source: NTIS (US Sales Only), PC A06/MF A01.

The differential emission probability of δ electrons was measured in the collisional systems $^{238}U+^{170}Er$, $^{238}U+^{108}Pd$, and $^{238}U+^{58}Ni$ at incident energies of 6.1 MeV/u at the UNILAC of the GSI in Darmstadt. Especially the dependence of the δ electron spectra on the impact parameter as well as on the total charge of the system was determined. The experimental arrangement consisted of two 90x90 cm^2 large position-resolving particle counters, an orange β spectrometer with plastic ring counters for the detection of the backward emitted electrons, and a diameter 5x3 cm^2 BGO γ detector. The electrons were taken up in coincidence to binary scattering events, which were in the analysis separated in scattering-angle dependent reaction classes, which reach up to the grazing angle. In the analysis of the data much made about the careful correction of the spectra regarding the background contributions from internal-pair and electron conversion of excited nuclear levels, because the conversion electrons in the systems with small Z_u represent a large contribution to the whole electron yield. The measured δ electron yield agrees for the systems U+Er and U+Pd in the purely elastic scattering range with results of coupled-channel calculations. Against that an increased yield in the measured spectra against the calculation in close collision results, which is presumably caused by nuclear interaction. The deviation from the theory amounts up to about 2 orders of magnitude in the system U+Pd and occurs still augmentedly in the lighter system U+Ni. The causes for this deviation are discussed. (orig.).

53944 (IFUSP-P–796) **Dynamical parity violation and the Chern Simons term.** Gomes, M.; Riveles, V.O.; Silva, A.J. da. Sao Paulo Univ., SP (Brazil). Inst. de Fisica. Jul 1989. 13p. Order Number DE91604986. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

A three dimensional model of two component spinors with a quadrilinear self interaction is considered. In the 1/N expansion the model turns out to be renormalizable and a mass term is generated, violating parity. This allows for the generation of a Chern Simons term if the spinor is coupled to an external gauge field. (A.C.A.S.).

53945 (IFUSP-P–804) **Giant resonances: reaction theory approach.** Toledo Piza, A.F.R. de; Foglia, G.A. Sao Paulo Univ., SP (Brazil). Inst. de Fisica. Sep 1989. 13p. Order Number DE91604987. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

The study of giant resonances through the use of reaction theory approach is presented and discussed. Measurements of cross-sections to the many available decay channels following excitation of giant multipole resonances (GMR) led one to view these phenomena as complicated dynamical syndromes so that theoretical requirements for their study must be extended beyond the traditional bounds of nuclear structure models. The spectra of decay products following GMR excitation in heavy nuclei are well described by statistical model (Hauser-Feshback, HF) predictions indicated that spreading of the collective modes plays a major role in shaping exclusive cross-sections. (A.C.A.S.).

53946 (ORNL/FTR–3774) **[Resonance ionization spectroscopy]: Foreign trip report, September 15, 1990–September 27, 1990.** Young, J.P. Oak Ridge National Lab., TN (USA). 11 Oct 1990. 8p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE91001202. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

J. P. Young attended the Fifth International Symposium on Resonance Ionization Spectroscopy and presented an invited oral presentation on research he and coworkers had carried out in applying diode lasers to resonance ionization mass spectrometry. A summary of the conference is given along with an assessment of some of the presentations that the author found of interest. Young also visited Professor Marassi at the University of Camerino to present a seminar and discuss mutual interests in a new molten salt research project of the author. Some of the studies at Camerino are described. Ideas concerning the author's research that came from private discussions are also presented here.

53947 (ORNL/FTR–3786) **[Structural investigation of curium bismuthide]: Foreign trip report, September 2, 1990–September 29, 1990.** Haire, R.G. Oak Ridge National Lab., TN (USA). 12 Oct 1990. 10p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE91001201. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The primary objective of the collaborative studies with EITU was to study curium bismuthide using energy dispersive X-ray diffraction to monitor its structure as a function of pressure. This objective was accomplished and the material was investigated up to 0.48 megabars of pressure. These studies were a continuation of established and productive collaborations between ORNL and EITU. The study of this curium compound is significant in that it is the first 5f-element bismuthide to be studied under pressure. Bismuth has the highest Z and the largest radius of the pnictogen group of elements (important for Hill Plot assessments) and has the greatest potential to form f-p type bonding with actinides under pressure. From a preliminary assessment of our experimental data it has been determined that two structural transitions occurred in the curium bismuthide sample as a result of the applied pressure.

53948 (UCRL-JC–104150) **Stimulated Raman scatter from laser-produced plasmas: Merely nonlinear or also chaotic?.** Drake, R.P.; Batha, S.H. Lawrence Livermore National Lab., CA (USA). 21 Aug 1990. 10p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-9007136–6: 1990 summer workshop on nonlinear and chaotic phenomena in plasmas, solids, and fluids, Edmonton (Canada), 16-27 Jul 1990). Order Number DE91001742. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Stimulated Raman scattering in plasmas is a three-wave instability with important practical consequences for laser fusion. Most studies of this process to date have focused on its threshold. Even the linear-theory threshold poses interesting problems; and observed thresholds have been difficult to interpret. However, with increasing evidence that this instability often becomes absolute, it has become appropriate to examine saturation mechanisms as well. A number of such mechanisms are discussed here, one of which has been reported to have a chaotic regime. 26 refs., 4 figs.

53949 (UCRL-JC–104991) **Inner-shell ionization of lithium-like chromium ions.** Vogel, D.A.; Beiersdorfer, P.; Marrs, R.E.; Wong, K.L.; Zasadzinski, R. Lawrence Livermore National Lab., CA (USA). 7 Sep 1990. 7p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-900923–3: 5. international conference on the physics of highly charged ions, Giessen (Germany, F.R.), 10-14 Sep 1990). Order Number DE91001749. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

We have used high-resolution x-ray spectroscopy to investigate inner-shell ionization of Cr^{21+} ions by electron impact using the Electron Beam Ion Trap at Lawrence Livermore Laboratory. Our measurements indicate that inner-shell ionization enhances the intensity of the radiative transition $1s2s\ ^3S_1 \rightarrow 1s^2\ ^1S_0$. 7 refs., 4 figs., 1 tab.

53950 (UCRL-JC–104992) **Electron impact ionization cross section measurement of lithium-like barium ions.** Wong, K. (Lawrence Livermore National Lab., CA (USA)); Beiersdorfer, P.; Vogel, D.A.; Marrs, R.E.; Levine, M. Lawrence Livermore National Lab., CA (USA). 7 Sep 1990. 7p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-900923–2: 5. international conference on the physics of highly charged ions, Giessen (Germany, F.R.), 10-14 Sep 1990). Order Number DE91001750. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

The electron impact ionization cross section of Li-like Ba^{53+} has been measured at 22 keV using an electron beam ion trap. The measurement makes use of a novel technique, which is discussed in detail. We find a value somewhat higher than predicted by theory.

53951 (UCRL-JC–106069) **Dielectronic recombination measurements at EBIT [Electron Beam Ion Trap].** Knapp, D.A. Lawrence Livermore National Lab., CA (USA). 4 Oct 1990. 6p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-900923–1: 5. international conference on the physics of highly charged ions, Giessen (Germany, F.R.), 10-14 Sep 1990). Order Number DE91001757. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The Electron Beam Ion Trap at the Lawrence Livermore National Laboratory has proved an ideal device for the study of interactions between electrons and highly-charged ions. I describe measurements of one such interaction, dielectronic recombination, in several ion species. The results are in marginal agreement with theoretical predictions. 8 refs., 6 figs.

53952 **Plasma lasers: Promises and limitations.** Silfvast, W.T. (Univ. of Central Florida, Center for Research in Electro-Optics and Lasers, FL (US)). pp. 1-6 of Lasers '89. Harris, D.G.; Shay, T.M. STS Press, McLean, VA (USA) (1990). pp. 1159 (CONF-891261–: Lasers '89: 12th international conference on lasers and applications, New Orleans, LA (USA), 3-8 Dec 1989).

Most gaseous or plasma layers operate in a regime where the electron or plasma density is high enough to be a limiting factor in laser power output. Improvements can therefore only be achieved by increasing the ratio of upper-laser-level population to electron density. This paper discusses how two relatively unstudied types of lasers, recombination-pumped lasers and photoionization-pumped lasers, have the potential to improve this ratio and thus, yield higher efficiency.

53953 **Nuclear transitions induced by atomic excitations.** Dyer, P. (Physics Div., Los Alamos National Lab., Los Alamos, NM (US)); Bounds, J.A.; Haight, R.C.; Luk, T.S. pp. 88-91 of Short and ultrashort wavelength lasers. Jones, C.R. Society of Photo-Optical Instrumentation Engineers, Bellingham, WA (USA) (1988). pp. 193 (CONF-8801144–: Short and ultrashort wavelength lasers meeting, Los Angeles, CA (USA), 14-15 Jan 1988).

In the two-step pumping scheme for a gamma-ray laser, an essential step is that of exciting the nucleus from a long-lived storage isomer to a nearby short- lived state that then decays to the upper lasing level. An experiment is in progress to induce this transfer by first exciting the atomic electrons with UV photons. The incident photons couple well to the electrons, which then couple via a virtual photon to the nucleus. As a test case, excitation of the ^{235}U nucleus is being sought, using a high- brightness UV laser. The excited nuclear state, having a 26- minute half-life, decays by internal conversion, resulting in emission of an atomic electron. A pulsed infrared laser produces an atomic beam of ^{235}U which is then bombarded by the UV laser beam. Ions are collected, and conversion electrons are detected by a channel electron multiplier. In preliminary experiments, an upper limit of 7×10^{-5} has been obtained for the probability of exciting a ^{235}U atom in the UV beam for one picosecond at an intensity of about 10^{15} W/cm^2. Experiments with higher sensitivities and at higher UV beam intensities are underway.

53954 **Modeling of atomic properties of plasmas.** Gupta, V. (Berkeley Research Associates, Inc., Springfield, VA (US)); Blaha, M.; Davis, J. pp. 52-59 of Short and ultrashort wavelength lasers. Jones, C.R. Society of Photo-Optical Instrumentation Engineers, Bellingham, WA (USA) (1988). pp. 193 (CONF-8801144–: Short and ultrashort wavelength lasers meeting, Los Angeles, CA (USA), 14-15 Jan 1988).

For overall modeling of radiative properties of plasmas in various conditions, a variety of atomic and thermodynamic data are required as input. In this paper, the authors outline work on calculation of photoionization cross-sections of atoms and ions and the modeling of equation-of-state properties of plasmas.

53955 **Toward shorter wavelengths for soft x-ray lasers based on Li-like ions.** Kim, D. (Princeton Plasma Physics Lab., Princeton, NJ (US)); Skinner, C.H.; Wouters, A.; Valeo, E.; Voorhees, D.; Suckewer, W. pp. 20-31 of Short and ultrashort wavelength lasers. Jones, C.R. Society of Photo-Optical Instrumentation Engineers, Bellingham, WA (USA) (1988). pp. 193 (CONF-8801144–: Short and ultrashort wavelength lasers meeting, Los Angeles, CA (USA), 14-15 Jan 1988).

The authors present recent experiments on soft x-ray amplification in lithium-like ions in a CO_2 laser-produced recombining plasma confined in a magnetic field. The maximum gain-length products observed are GL $\simeq$ 3 - 4 for the 154 Å, 4f - 3d transition

in Al XI and GL $\simeq$ 1 - 2 for the 129 Å, 4f-3d transition in Si XII, respectively. A one- dimensional hydrodynamic code with a collisional-radiative atomic model was used to model the plasma and comparisons of theoretical results with experimental observation are discussed. Descriptions of both hydrodynamic and atomic physics code are given.

53956 **A nuclear structure of the proposed gamma-ray laser candidate nucleus ^{186}Re.** Madland, D.G. (Theoretical Div., Los Alamos National Lab., Los Alamos, NM (US)); Strottman, D.D. pp. 103-108 of Short and ultrashort wavelength lasers. Jones, C.R. Society of Photo-Optical Instrumentation Engineers, Bellingham, WA (USA) (1988). pp. 193 (CONF-8801144–: Short and ultrashort wavelength lasers meeting, Los Angeles, CA (USA), 14-15 Jan 1988).

The authors present results of theoretical nuclear structure model calculations for the gamma-ray laser candidate nucleus ^{186}Re. Their calculations of this odd-odd transitional nucleus are based on an axially-asymmetric (particle plus triaxial rotor) model for constructing the orbitals of the odd nucleons that couple under the influence of the residual neutron-proton interaction. The authors include pairing correlations by using the BCS approximation with newly determined pairing strengths. The matrix elements of the residual neutron- proton interaction are obtained using phenomenological spin- dependent δ function potentials of both surface and volume forms. They examine the sensitivity of the calculated low-excitation level structure of ^{186}Re to the strength of these potentials.

53957 **Shape isomers as candidates for the gamma ray laser storage state.** Weiss, M.S. (Lawrence Livermore National Lab., Physics Dept., Livermore, CA (US)). pp. 109-116 of Short and ultrashort wavelength lasers. Jones, C.R. Society of Photo-Optical Instrumentation Engineers, Bellingham, WA (USA) (1988). pp. 193 (CONF-8801144–: Short and ultrashort wavelength lasers meeting, Los Angeles, CA (USA), 14-15 Jan 1988).

Three dimension Nuclear Hartree-Fock calculations have been performed for isotopes of osmium, mercury, and tungsten. Many of the calculated potential energy surfaces show a second minimum at large prolate deformation indicating the possibility of shape isomeric states. Several are at sufficiently low energy to be possible candidates as storage states for the gamma ray laser.

53958 **Conversion-electron experiment to characterize the decay of the ^{237}Np shape isomer.** Henry, E.A. (Lawrence Livermore National Lab., Livermore, CA (US)); Becker, J.A.; Bauer, R.W.; Gardner, D.G.; Decman, D.J.; Meyer, R.A.; Roy, N.; Sale, K.E. pp. 120-125 of Short and ultrashort wavelength lasers. Jones, C.R. Society of Photo-Optical Instrumentation Engineers, Bellingham, WA (USA) (1988). pp. 193 (CONF-8801144–: Short and ultrashort wavelength lasers meeting, Los Angeles, CA (USA), 14-15 Jan 1988).

Conversion electrons from the decay of low-lying levels of ^{237}Np have been measured to detect the population of these levels by gamma-ray decay of the ^{237}Np shape isomer. Analysis of the 208-keV transition L conversion-electron peak gives an upper limit of about 17 μb for the population of the 3/2$^-$ 267-keV level in ^{237}Np from the shape isomer decay. Model calculations are compared with the measured limit. Improvements are suggested for this experiment.

53959 **SANS measurement of deuterium-dislocation correlation in palladium.** Heuser, B.J. (Univ. of Michigan, Ann Arbor, MI (US)); Summerfield, G.C.; King, J.S.; Epperson, J.E. pp. 273-280 of Neutron scattering for materials science. Materials Research Society proceedings: Volume 166. Shapiro, S.M.; Moss, S.C.; Jorgensen, J.D. Materials Research Society, Pittsburgh, PA (USA) (1990). pp. 499 (CONF-891119–: Materials Research Society fall meeting, Boston, MA (USA), 27 Nov - 2 dec 1989).

Small angle neutron scattering (SANS) measurements have been made on deformed polycrystal palladium samples with and without deuterium dissolved in the solution phase (α) at room temperature. Concentrations were held constant during SANS experiments by an equilibrium gas pressure cell. The difference scattering cross section for the same sample with and without deuterium loading has a 1/Q behavior ($Q = 4\pi/\lambda \sin\theta/2$) at intermediate values of Q. At very low values of Q the dependence is much stronger than 1/Q. The 1/Q behavior is attributed to deuterium trapping close to long dislocation cores forming rod-like scattering structures.

53960 **Measurement of the stimulated thermal Rayleigh scattering instability.** Karr, T.J. (Lawrence Livermore National Lab., CA (USA)); Rushford, M.C.; Murray, J.R.; Morris, J.R. pp. 693-702 of Lasers '89. Harris, D.G.; Shay, T.M. STS Press, McLean, VA (USA) (1990). pp. 1159 DOE Contract W-7405-ENG-48. (CONF-891261–: Lasers '89: 12th international conference on lasers and applications, New Orleans, LA (USA), 3-8 Dec 1989).

The authors report the first clear experimental demonstration of large amplification of small-scale spatial perturbations by stimulated thermal Rayleigh scattering (STRS) of a CW laser beam propagating through an absorbing medium in a context normally associated with thermal blooming. A single-mode argon-ion laser beam with λ = 488nm was propagated vertically downward through a 1.2 m cell filled with CCl_4 that was doped with an absorber to have optical depths in the range 0.5-2.3. A shear-plate interferometer near the cell input generated the perturbation. Fringe growth was rapid and visually obvious, as was competing growth from dust specks, etc. The measured growth rate is good agreement with asymptotic rate from analytic STRS theory.

53961 **Laser optogalvanic spectroscopy.** McGlynn, S.P. (Louisiana State Univ., Baton Rouge, LA (USA). Dept. of Chemistry); Kumar, D. pp. 753-756 of Lasers '89. Harris, D.G.; Shay, T.M. STS Press, McLean, VA (USA) (1990). pp. 1159 (CONF-891261–: Lasers '89: 12th international conference on lasers and applications, New Orleans, LA (USA), 3-8 Dec 1989).

Various configurations for laser optogalvanic (LOG) studies are discussed. Emphasis is placed on pulsed laser optogalvanic spectroscopy of atoms and molecules (Xe, Cs, Ne, I_2) in a radiofrequency discharge. The photoacoustic effect is found to be a major contributor to the LOG signal. The nature and magnitude of this contribution is assessed.

53962 **VUV and laser Raman study of the correlation between atomic and molecular polarizabilities and the number density shifts.** Rupnik, K. (Louisiana State Univ., Baton Rouge, LA (USA). Dept. of Chemistry). pp. 774-781 of Lasers '89. Harris, D.G.; Shay, T.M. STS Press, McLean, VA (USA) (1990). pp. 1159 (CONF-891261–: Lasers '89: 12th international conference on lasers and applications, New Orleans, LA (USA), 3-8 Dec 1989).

This work investigates the possible mechanisms of the radiative (VUV field induced) momentum transfer or coupling between the molecular perturbers and high-n Rydberg absorbers. A phase space approach using correlation functions is proposed for the interpretation of these processes in the gases. It is found from the density shift study, that the atomic and anisotropic molecular polarizabilities are related to a single function describing high-n Rydberg transitions. The authors propose VUV and Raman study of the number density effects for some of the following systems (HF, NH_3, C_2H_4, H_2CO, CO_2, HCN, C_2H_2, and CH_3CN).

53963 **Nature of laser optogalvanic signals.** Kumar, D. (Louisiana State Univ., Baton Rouge, LA (USA). Dept. of Chemistry); McGlynn, S.P. pp. 757-760 of Lasers '89. Harris, D.G.; Shay, T.M. STS Press, McLean, VA (USA) ([1990]). pp. 1159 (CONF-891261–: Lasers '89: 12th international conference on lasers and applications, New Orleans, LA (USA), 3-8 Dec 1989).

Laser optogalvanic (LOG) signals are believed to be generated primarily by laser-induced changes in the equilibrium ionization rate of a discharge. Recent work has shown that photoacoustic (PA) effects can also play an important role in the generation of LOG signals and that no thermal effects or ionization rate changes are involved in the final step of such signal production. The PA mediated components may be superimposed on the other components and a complex temporal profile of the LOG signal may result. The authors report a technique by which the two types of components may be distinguished even when they overlap temporally. This technique is applicable to rf discharges, and concerns marked changes induced in the temporal profiles of LOG signals as the rf frequency is altered about the resonance frequency. Results from time-resolved studies in a ~30 MHz rf discharge in ~5torr neon are presented.

53964 Picosecond multiphoton ionization of atomic and molecular clusters. Smith, D.B. (Engineering Physics Dept., Applied Technology Div., Oak Ridge National Lab., Oak Ridge, TN (USA)); Miller, J.C. pp. 737-742 of Lasers '89. Harris, D.G.; Shay, T.M. STS Press, McLean, VA (USA) (1990). pp. 1159 DOE Contract AC05-84OR21400. (CONF-891261–: Lasers '89: 12th international conference on lasers and applications, New Orleans, LA (USA), 3-8 Dec 1989).

High peak-power picosecond laser pulses have been used to effect non-resonant multiphoton ionization (MPI) of atomic and molecular clusters. The clusters were produced in a free-jet expansion from a nozzle source, and the photoions produced by MPI were detected and characterized by time-of-flight mass spectroscopy. The authors discuss the observation of the cluster series Xe_{1-19}^+, $Ar_{1-7}NO^+$,NO_{1-5}^+ and $Ar_{1-7}I^+$. Previous MPI studies of the laser two species have not been successful, presumably due to the existence of fast dissociation channels. It is proposed that the present technique is a new and rather general ionization source for cluster studies that is complimentary to electron impact and that may also provide unique spectroscopic or dynamical information.

53965 Kinetics and Spectroscopy of KrF(B) and $Kr_2F(4^2\Gamma)$. McCown, A.W. (Laser Science and Application Group, Los Alamos National Lab., Los Alamos, NM (USA)); Greene, D.P. pp. 767-773 of Lasers '89. Harris, D.G.; Shay, T.M. STS Press, McLean, VA (USA) (1990). pp. 1159 (CONF-891261–: Lasers '89: 12th international conference on lasers and applications, New Orleans, LA (USA), 3-8 Dec 1989).

The absorption spectra corresponding to transitions from the $4^2\Gamma$level to upper excited states of several rare gas-halide trimers (Kr_2F, Ar_2F and Xe_2Cl) have been measured at wavelengths ranging from 200 nm to as large as 800 nm. Absolute absorption cross sections for Kr_2F have been determined. Experiments are discussed that will measure the radiative lifetime of the KrF (B) state which is formed utilizing a sub-picosecond source. KrF B ← C mixing, quenching rates and B → X stimulated emission cross section will be measured.

53966 Electrolytic tritium production. Storms, E. (Los Alamos National Lab., Nuclear Materials Technology Div. and Material Science and Technology Div., MS C348, Los Alamos, NM (US)); Talcott, C. *Fusion Technology (USA)*, 17(4): 680-695 (Jul 1990).

This paper reports fifty-three electrolytic cells of various configurations and electrode compositions examined for tritium production. Significant tritium was found in 11 cells at levels between 1.5 and 80 times the starting concentration after enrichment corrections are made.

53967 Calorimetric measurements of the palladium/deuterium system: Fact and fiction. Pons, S. (Utah Univ., Salt Lake City, UT (USA). Dept. of Chemistry); Fleischmann, M. *Fusion Technology (USA)*, 17(4): 669-679 (Jul 1990).

The technique, model, and experimental procedures as used in the Fleischmann–Pons calorimetric investigations are described.

53968 [Relationships between microscope structure and thermodynamic properties]. Wu, R.S. (School of Chemical Engineering and Materials Science, Univ. of Oklahoma, Norman, OK (US)); Lee, L.L.; Cochran, D. *Industrial and Engineering Chemistry Research (USA)*, 29(6): 977-987 (Jun 1990). DOE Contract AC05-84OR21400.

This paper exhibits on the molecular level, the relationships between the microscopic structure and thermodynamic properties of dilute supercritical solutions by application of the integral equation theories for molecular distribution functions. To solve the integral equations, the authors use Baxter's Wiener-Hopf factorization of the Ornstein-Zernike equations and then apply this method to binary Lennard-Jones mixtures. A number of closure relations have been used: such as the Percus-Yevick (PY), the reference hypernetted chain (RHNC), the hybrid mean spherical approximation (HMSA), and the reference interaction-site (RISM) methods. The authors examine the microstructures of several important classes of supercritical mixtures, including the usual attractive-type and the less known repulsive-type solutions. The clustering of solvent molecules for solvent-solute structures in the attractive mixtures and, correspondingly, the solvent cavitation in the repulsive mixtures are clearly demonstrated. These are shown to be responsible for the large negative growth of the solute partial molar volumes in the attractive case and the positive growth in the repulsive case.

53969 Low-energy autoionization spectra of doubly excited states in $B^+(1s^22pnl, n\geq4)$. Bruch, R. (Atomic and Molecular Collision Laboratory, Department of Physics, University of Nevada, Reno, Reno, NV (USA)); Fuelling, S.; Schneider, D.; Moores, D.L.; Stettner, U.; Litzen, U.; Skogvall, B. *Physical Review, A (General Physics) (USA)*, 42(3): 1200-1205 (1 Aug 1990). DOE Contract W-7405-ENG-48.

An experimental and theoretical study is presented of the $B^+(1s^22pnl, n=4$ and 5) doubly excited states. Experimentally, low-energy electron emission spectra of B^+, excited by B^++He, B^++Ar, and B^++C-foil collisions, have been recorded with a zero-degree electron spectrometer setup. Several autoionizing states of B^+ have been observed between 1 and 3 eV in the projectile emitter frame. The observed resonances, namely, $(1s^22p4s)\ ^3P^0$, $^1P^0$, $(1s^22p4p)\ ^3D,^1D$, $(1s^22p4d)\ ^3P^0$, $^1P^0$, $(1s^22p4d)\ ^3P^0$, and $^1P^0$ do not appear in any previous data. The observations also suggest that the population of triply excited states in *B* is not important in the excitation process. Theoretically, five-state (2*s*,2*p*,3*s*,3*p*,3*d*) close-coupling calculations using IMPACT have been performed to determine positions, widths, and partial collision strengths for 22 of the lowest $B^+(1s^22pnl)$ resonance states. Excellent agreement between theoretical and experimental energy positions is obtained.

53970 Electron emission in He^+-atom and He^+-molecule collisions: A combined experimental and theoretical study. DuBois, R.D. (Pacific Northwest Laboratory, Richland, Washington 99352 (USA)); Manson, S.T. *Physical Review, A (General Physics) (USA)*, 42(3): 1222-1230 (1 Aug 1990). DOE Contract AC06-76RL01830.

An experimental and theoretical study of the electron emission, differential in emission angle and energy, is presented for He^+ impact on several gaseous targets. Experimentally, data at 400-, 500-, and 750-keV/amu impact on He, Ne, Ar, Kr, and H_2O are presented; theoretically, cross sections for He and Ar are calculated using the first-order Born approximation. By measuring the total electron emission, as well as electron-scattered projectile coincidences, contributions to the differential cross sections resulting from projectile ionization, from target ionization, and from simultaneous projectile-target ionization events are identified. Theoretical cross sections for each of these processes, as well as their total sum, are compared with the experimental data. From these comparisons, it is found that the present theoretical treatment does a reasonable job of describing the total projectile and target ionization cross sections, but is poor for the double-differential cross section. It also severely underestimates the simultaneous projectile-target ionization cross section.

53971 Photoionization of Na: Resonance enhancement of the single-channel cross section. Msezane, A.Z. (Department of Physics, Clark Atlanta University, Atlanta, Georgia 30314 (USA)); Armstrong-Mensah, W.; Niles, J. *Physical Review, A (General Physics) (USA)*, 42(3): 1286-1292 (1 Aug 1990).

Total and partial photoionization cross sections for the ground state of Na leaving the residual Na^+ ions in the three ($2p^6\,S$, $2p^5 3s\ ^{3,1}P^0$) and seven ($2p^6\ ^1S$, $2p^5 3s\ ^{3,1}P^0$, $2p^5 3p\ ^3S,^{3,1}D,^1P$) lowest *LS* states are calculated using the *R*-matrix method. Additionally, a 12-state *R*-matrix calculation is performed leaving the residual Na^+ ions in *LS* states of the $2p^6$, $2p^5 3s$, and $2p^5 3p$ manifolds and $2p^5 3d\ (^{3,1}P^0,^1D^0)$ to determine the cross-section magnitudes of the satellite levels $2p^5 3p\ ^1S$ and $2p^5 3d\ ^{3,1}P^0$ and to assess their influence on the total cross section.

53972 Two-photon transitions in atomic inner shells: Relativistic and atomic-screening effects. Tong, X. (Institute of Physics, Academia Sinica, Beijing (China)); Li, J.; Kissel, L.; Pratt, R.H. *Physical Review, A (General Physics) (USA)*, 42(3): 1442-1449 (1 Aug 1990). DOE Contract AC04-76DP00789.

We present a relativistic self-consistent-field calculation of two-photon decay rates in atomic inner shells. By comparing our relativistic two-photon decay rates for Mo, Ag, and Xe with results for a series of hydrogenlike ions and existing nonrelativistic results,

we identify and clarify the nature of the relativistic effects and atomic screening effects: (1) the relativistic effects reduce the two-photon decay rates compared with the nonrelativistic results; (2) screening reduces the atomic two-photon decay rates compared with the corresponding H-like ions. We also compare our results with recent experiments and with other theoretical calculations. Our results are in reasonable agreement with the experimental measurements, except for the $2s$-$1s$ transitions, and with other theoretical calculations, except for the nd-$1s$ results of Mu and Crasemann [Phys. Rev. Lett. 57, 3039 (1986); Phys. Rev. A 38, 4585 (1988)].

53973 A study of the thermodynamic and reducing properties of lithium in cadmium at 773 K. Lewis, M.A. (Argonne National Lab., Chemical Technology Div., Argonne, IL (US)); Johnson, T.R. *Journal of the Electrochemical Society (USA)*, 137(5): 1414-1418 (May 1990).

This paper reports the activity of lithium in cadmium measured in a two-phase system of molten chloride salts and cadmium metal at 773 K using a calibrated silver/silver chloride reference electrode. The activity coefficients of lithium in dilute cadmium solutions were found to depend on lithium concentration, varying from 1.8×10^{-3} to 2.6×10^{-3} over a concentration range of 0.06–7.0 atom percent (a/o). The distribution coefficients of cerium, neodymium, praseodymium, and yttrium in a similar salt-cadmium system were obtained as a function of lithium activity. Because the distribution coefficients were proportional to the third power of the lithium activity, the oxidation state of these rare earths in the chloride salt phase was shown to be three. The presence of as little as 0.4 a/o rare earths in the metal phase increased the lithium activity.

53974 Labeling conventions in isoelectronic sequences. Maniak, S.T. (Department of Physics and Astronomy, University of Toledo, Toledo, Ohio 43606 (USA)); Curtis, L.J. *Physical Review, A (General Physics) (USA)*, 42(3): 1821-1823 (1 Aug 1990). DOE Contract FG05-88ER13958.

The isoelectronic exposition of atomic structure properties involves labeling ambiguities when more than one level of the same total angular momentum and parity is present, and an energy ordered labeling of these levels can lead to apparent isoelectronic discontinuities. For example, in the recent oscillator strength calculations for S-like ions by Saloman and Kim [Phys. Rev. A 38, 577 (1988)], abrupt changes in the rates were sometimes observed between one isoelectronic element and the next. We suggest an alternative labeling scheme that removes these discontinuities and produces a smooth isoelectronic variation. This alternative labeling offers advantages for data exposition and for semiempirical interpolation and extrapolation.

6404 Fluid Physics

Refer also to citation(s) 53160, 53463, 53599, 54194, 54290, 54386, 54408, 54419

53975 (BNL–45182) **Phase portrait methods for verifying fluid dynamic simulations.** Stewart, H.B. Brookhaven National Lab., Upton, NY (USA). [1989]. 20p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. (CONF-8909178–2: US-Korea joint seminar on fluids engineering and science, Seoul (Republic of Korea), 3-9 Sep 1989). Order Number DE91001129. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

As computing resources become more powerful and accessible, engineers more frequently face the difficult and challenging engineering problem of accurately simulating nonlinear dynamic phenomena. Although mathematical models are usually available, in the form of initial value problems for differential equations, the behavior of the solutions of nonlinear models is often poorly understood. A notable example is fluid dynamics: while the Navier-Stokes equations are believed to correctly describe turbulent flow, no exact mathematical solution of these equations in the turbulent regime is known. Differential equations can of course be solved numerically, but how are we to assess numerical solutions of complex phenomena without some understanding of the mathematical problem and its solutions to guide us?

53976 (SAND–90-0179C) **Instability of a supersonic shock free elliptic jet.** Baty, R.S. (Sandia National Labs., Albuquerque, NM (USA)); Seiner, J.M.; Ponton, M.K. Sandia National Labs., Albuquerque, NM (USA). [1990]. 14p. Sponsored by National Aeronautics and Space Administration. DOE Contract AC04-76DP00789. (CONF-9010223–1: 13. AIAA aeroacoustics conference, Tallahassee, FL (USA), 22-24 Oct 1990). Order Number DE91001231. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This paper presents a comparison of the measured and the computed spatial stability properties of an aspect ratio 2 supersonic shock free elliptic jet. The shock free nature of the elliptic jet provides an ideal test of validity of modeling the large scale coherent structures in the initial mixing region of noncircular supersonic jets with linear hydrodynamic stability theory. Both aerodynamic and acoustic data were measured. The data are used to compute the mean velocity profiles and to provide a description of the spatial composition of pressure waves in the elliptic jet. A hybrid numerical scheme is applied to solve the Rayleigh problem governing the inviscid linear spatial stability of the jet. The measured mean velocity profiles are used to provide a qualitative model for the cross sectional geometry and the smooth velocity profiles used in the stability analysis. Computational results are presented for several modes of instability at two jet cross sections. The acoustic measurements show that a varicose instability is the jet's perferred mode of motion. The stability analysis predicts that the Strouhal number varies linearly as a function of axial distance in the jet's initial mixing region, which is in good qualitative agreement with previous measurements. 18 refs., 18 figs., 1 tab.

53977 Generation of superfluid vortex turbulence by high-amplitude second sound in ^{4}He. Kotsubo, V. (Los Alamos National Laboratory, NM (USA)); Swift, G.W. *Journal of Low Temperature Physics (USA)*, 78(5-6): 351-373 (Mar 1990).

High-amplitude second sound in superfluid ^{4}He is used to generate vortex turbulence. By the use of a novel resonator designed to avoid nonlinear effects, a steady-state ac counterflow field is produced with amplitudes high enough to generate the turbulent state. The transition to the turbulent state shows hysteresis similar to that observed in dc superflow measurements. Critical velocities were measured as a function of both temperature and frequency. The frequency dependence agrees with the predictions of dynamic scaling theory, and the temperature dependence is the same as that observed in dc counterflow experiments.

6450 High Energy Physics

Refer also to citation(s) 53554, 53887

53978 (FNAL/C–90/164-T) **Quantum chromodynamics (QCD) and collider physics.** Ellis, R.K. (Fermi National Accelerator Lab., Batavia, IL (USA)); Stirling, W.J. Fermi National Accelerator Lab., Batavia, IL (USA). 14 Aug 1990. 128p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH03000. (CONF-8906368–1: CERN-JINR school of physics, Geneva (Switzerland), 25 Jun - 8 jul 1989). Order Number DE91001543. Source: NTIS, PC A07/MF A01; OSTI; INIS; GPO Dep.

This report discusses: fundamentals of perturbative QCD; QCD in $e^+e^- \rightarrow$ hadrons; deep inelastic scattering and parton distributions; the QCD parton model in hadron-hadron collisions; large p_T jet production in hadron-hadron collisions; the production of vector bosons in hadronic collisions; and the production of heavy quarks.

53979 (LBL–29405) **From the neutron to three light neutrino species: Some highlights from sixty years of particle physics.** Goldhaber, G. Lawrence Berkeley Lab., CA (USA). Jul 1990. 68p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-9007173–1: Dalitz conference, Oxford (UK), 5 Jul 1990). Order Number DE91000168. Source: NTIS, PC A04/MF A01; OSTI; INIS; GPO Dep.

I consider the beginning to modern particle physics to be in 1932–33, when James Chadwick discovered the neutron at Cambridge, England, and Carl Anderson discovered the positron in Pasadena, California. I leave out the discoveries of the electron by J. J. Thomson, the nucleus and the proton by Ernest Rutherford,

as well as the photon introduced by Albert Einstein and the neutrino as hypothesized by Wolfgang Pauli, as having occurred "before my time." I was thus able to follow – and sometimes participate in – all the developments of modern particle physics. The story I will tell is as the unfolding of the field looked; to me – an experimental particle physicists. As with Rashomon, this is as I see it. To get a different point of view, and no doubt there are many, you need different observer. One might ask, what did I know about physics in the 1930s, anyway? It so happens that I did hear abut Chadwick's discovery at the time, mainly because my brother Maurice was working with him in 1934 on the photo-disintegration of the deuteron, and on the first good measurement of the neutron mass. I will concentrate on the thirty years, 1930 to 1960 which includes Dick Dalitz' important early contributions. I will then skip most of the next thirty years for lack of time, and end up with the study of the Z^0 in e^+e^- annihilation. For more details, and explicit references to published papers, I will refer the reader to a recent book by Robert Cahn and myself.

53980 (ORNL/FTR–3699) **[The 25th international conference on high-energy physics at Singapore]: Foreign trip report, July 21, 1990–August 9, 1990.** Plasil, F. Oak Ridge National Lab., TN (USA). 17 Aug 1990. 6p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE91001154. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The traveler attended the 25th International Conference on High-Energy Physics in Singapore, August 1–8, 1990. The conference was dominated by results from the new LEP accelerator at CERN. The precision of the data from LEP is impressive, and all results are consistent with the standard model. No "new physics" has emerged at LEP. The traveler presented a talk on CERN/SPS WA80 results and had several interesting, private discussions on both L* and WA80 topics.

6451 Particle Interactions and Properties - Experimental

Refer also to citation(s) 53456, 53562, 53909, 53913, 54029, 54036, 54073, 54080, 54085

53981 (AD-A–224498/6/XAB) **Antiproton studies in Penning traps. Final report, 1 February 1986-31 December 1988.** Gabrielse, G. Washington Univ., Seattle, WA (USA). Dept. of Physics. 31 Dec 1988. 7p. Grant AFOSR-86-0069. Source: NTIS, PC A02/MF A01.

During the course of this research, several trips were made to LEAR (the Low Energy Antiproton Ring) in Geneva. On one trip, the feasibility of using a thick beryllium degrader to slow antiprotons enough to permit capture was established. On another trip, approximately 1000 antiprotons were captured and held for about ten minutes. Subsequently, a completely new apparatus was designed using a proper superconducting magnet, and a beam line at LEAR was designed for the mass measurement. At the end of the research period, all apparatus and arrangements were complete for making the measurement of the antiproton inertial mass.

53982 (BNL–45115) **Overview of high energy physics with polarized particles.** Soffer, J. (Centre National de la Recherche Scientifique, 13 - Marseille (France). Centre de Physique Theorique). Brookhaven National Lab., Upton, NY (USA). Aug 1990. 14p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. (CONF-900726–3: International conference on polarization phenomena in nuclear physics, Paris (France), 9-13 Jul 1990). Order Number DE91001119. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The purpose of this talk is to review spin effects in various areas of particle physics at high energy and by selecting the most interesting topics, to show the relevance of dealing with polarized particles. We will see that it provides crucial tests for the Standard Model and can give us clear signatures to uncover new interactions. We will also discuss some striking experimental facts recently observed in hadronic collisions and their implications for current theoretical ideas. 43 refs., 10 figs.

53983 (BNL–45162) **Total and elastic pp cross sections at RHIC.** Guryn, W. (Brookhaven National Lab., Upton, NY (USA)); Sakitt, M.; Sambamurti, A.; Lee, S.Y.; Majewski, S. Brookhaven National Lab., Upton, NY (USA). Aug 1990. 11p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. (CONF-900772–6: 4. workshop on experiments and detectors for a relativistic heavy ion collider, Upton, NY (USA), 2-7 Jul 1990). Order Number DE91001247. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

We have examined the feasibility of studying elastic proton-proton (pp) scattering $\sqrt{s}$ = 500 GeV, in the small angle scattering hall at RHIC. The requirements for the intersection region and the detector are described. The lattice configuration and the angular coverage of the detector will allow the simultaneous study of all three regions that characterize elastic scattering, namely the Coulomb dominated region, the Coulomb-hadronic interference region and the hadronic dominated region. 11 refs., 2 figs.

53984 (BNL–45186) **Hadron spectroscopy at RHIC.** Chung, S.U.; Kern, W.; Willutzki, H.J. Brookhaven National Lab., Upton, NY (USA). Aug 1990. 12p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. (CONF-900772–8: 4. workshop on experiments and detectors for a relativistic heavy ion collider, Upton, NY (USA), 2-7 Jul 1990). Order Number DE91001248. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

A description is given of the physics opportunities at RHIC regarding quark-gluon spectroscopy. The basic idea is to isolate with appropriate triggers the subprocesses pomeron + pomeron → hadrons and $\gamma^* + \gamma^* \rightarrow$ hadrons with the net effective mass of hadrons in the range of 1.0 to 3.0 GeV, in order to study the hadronic states composed of u, d, and s and gluons. The double-pomeron interactions are expected to produce glueballs and hybrids preferentially, while the two-offshell-photon initial states should couple predominantly to quarkonia and multiquark states. A plethora of J^{PC}-exotic mesons can be produced either directly in both types of interactions or in association with a single recoil photon in the final state. 8 refs., 2 figs.

53985 (BNL–45245) **An experiment to study strong electromagnetic fields at RHIC.** Fatyga, M. (Brookhaven National Lab., Upton, NY (USA)); Norbury, J.W. Brookhaven National Lab., Upton, NY (USA). [1990]. 23p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. (CONF-900772–7: 4. workshop on experiments and detectors for a relativistic heavy ion collider, Upton, NY (USA), 2-7 Jul 1990). Order Number DE91001243. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

We present a description of an experiment which can be used to search for effects of strong electromagnetic fields on the production of e^+e^- pairs in the elastic scattering of two heavy ions at RHIC. A very brief discussion of other possible studies of electromagnetic phenomena at RHIC is also presented.

53986 (BNL–45246) **Status of soft photons in experiment E855.** Woody, C. (Brookhaven National Lab., Upton, NY (USA)); Lissauer, D.; Gomez del Campo, J.; Ray, A.; Shapira, D.; Tincknell, M.; Clark, R.; Erd, C.; Schukraft, J.; Willis, W. Brookhaven National Lab., Upton, NY (USA). [1990]. 10p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. (CONF-9009275–1: Workshop on soft lepton pair and photon production, Pittsburg, PA (USA), 6-8 Sep 1990). Order Number DE91001244. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

Experiment E855 was carried out at the AGS at Brookhaven National Laboratory to study soft photon production near center of mass rapidity $Y_{cm} \sim 0$ in proton-nucleus collisions at 10 at 18 GeV/c. This was the first dedicated experiment to study this phenomenon at these lower energies. It is important to note that the related process of low mass dilepton pair production has been studied extensively at these energies and an excess signal of dileptons above known hadronic backgrounds has been firmly established. E855 was designed to measure photon production from $P_t \sim 5$ MeV/c up to several GeV/c. A search will be made for an excess of soft photons in the P_t region below the Jacobian peak from π^0 decays, above that which is expected from hadronic bremsstrahlung. Any observed signal will be correlated with the total charged multiplicity in the event in order to determine its production mechanism. This correlation can be used to distinguish purely hadronic sources of soft photons, such as mesons decays

and bremsstrahlung, which vary linearly with the charged multiplicity, and a thermal source of soft photons which would exhibit a quadratic dependence on the charged multiplicity. In addition, E855 will measure low energy photons from nuclear decays which can be a background for measuring soft photons near $Y_{cm} \sim 0$. These photons are also interesting from a nuclear physics point of view, since the spectrum of photons from nuclei excited by incident high energy protons gives a measure of the temperature of the excited nucleus and the amount of excitation energy which can be transferred to a nucleus in a high energy proton collision.

53987 (CEA-CONF–10130) **Electron scattering and few-nucleon systems.** Frois, B. CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Service de Physique Nucleaire a Haute Energie. 1989. 16p. (CONF-8907150–: 12. course of the International School of Nuclear Physics: the nature of hadrons and nuclei studied by electron scattering, Erice (Italy), 16-25 Jul 1989). Order Number DE91716287. Source: NTIS (US Sales Only), PC A03/MF A01.

Recent data on the ground state charge and magnetization distributions of few-nucleon systems are reviewed. The contribution of meson-exchange currents is discussed.

53988 (DESY–90-088) **Study of inclusive semileptonic B meson decays.** Albrecht, H. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)); Ehrlichmann, H.; Glaeser, R.; Harder, G.; Krueger, A.; Nau, A.; Nilsson, A.W.; Nippe, A.; Oest, T.; Reidenbach, M.; Schaefer, M.; Schmidt-Parzefall, W.; Schroeder, H.; Schulz,ARGUS Collaboration. Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.). Jul 1990. 15p. Order Number DE91717062. Source: NTIS (US Sales Only), PC A03/MF A01.

Using the ARGUS detector at the e^+e^- storage ring DORIS-II, we have measured the inclusive semileptonic decays of B-mesons into electrons and muons. The data originate from 220.5 events/pb on the $\Gamma(4S)$ resonance. We find $BR(B \to e^+\nu_e X)=(10.3\pm0.6\pm0.2)\%$ and $BR(B \to \mu^+\nu_\mu X)=(10.0\pm0.6\pm0.2)\%$ using the model of Altarelli et al. for extrapolating over all lepton momenta, and $BR(B \to e^+\nu_e X)=(9.9\pm0.6)\%$, $BR(B \to \mu^+\nu_\mu X)=(9.7\pm0.6)\%$ using the model of Grinstein et al. For semileptonic decays into baryons, we obtain an upper limit of $BR(B \to \text{anti } pe^+\nu X)<0.16\%$ (90% CL). (orig.).

53989 (DESY–90-089) **A comparison of measured jet cross sections with QCD calculations for e^+e^- annihilation.** Magnussen, N. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)); Bartel, W.; Felst, R.; Haidt, D.; Kado, H.; Knies, G.; Krehbiel, H.; Meinke, R.; Meyer, H.; Olsson, J.; Ramcke, R.; Schmidt, D.; Steffen, P.; Smolik, L.; Ambrus, K.; Bethke,.JADE Collaboration. Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.). Jul 1990. 28p. Order Number DE91717064. Source: NTIS (US Sales Only), PC A03/MF A01.

The cross sections for 2-, 3- and 4-jet production have been determined with the JADE detector, sited on the e^+e^--storage ring PETRA. Data at $\sqrt{s}$=14, 22, 35 and 44 GeV were compared to two $O(\alpha_s^2)$ QCD calculations. A first analysis was performed with uncorrected data using the $O(\alpha_s^2)$ 3-jet matrix element calculation of Ellis, Ross and Terrano and the Lund String Monte Carlo program. In a second analysis the calculation of Kramer and Lampe was compared to corrected data. Both approaches gave a poor description of the data when the square of the momentum transfer Q^2=s was used as the scale of the running coupling constant. The description improved when the renormalization scale was adjusted to the process studied. The data were used to fix the best renormalization scale. (orig.).

53990 (DOE/ER/02504–516) **High energy accelerator and colliding beam user group: Progress report, March 1, 1990–February 28, 1991.** Maryland Univ., College Park, MD (USA). Dept. of Physics and Astronomy. Sep 1990. 133p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-76ER02504. Order Number DE91001615. Source: NTIS, PC A07/MF A01; OSTI; INIS; GPO Dep.

This report discusses the following topics: OPAL experiment at LEP; Dϕ experiment at Fermilab; deep inelastic muon interactions at TEV II; CYGNUS experiment; final results from ν_e–^{9} elastic scattering; physics with CLEO detector at CESR; results from JADE at PETRA; rare kaon-decay experiment at BNL; search for top quark; and super conducting super collider activities.

53991 (DOE/ER/40389–67) **Experimental investigations in particle physics at intermediate energies: Performance report, January 1, 1990–November 30, 1990.** Auerbach, L.B.; Highland, V.L.; Martoff, C.J.; McFarlane, K.W.; Guss, C.; Kettell, S. Temple Univ., Philadelphia, PA (USA). Dept. of Physics. 24 Jul 1990. 25p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-88ER40389. Order Number DE91001668. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

This paper discusses: neutrino interactions at LAMPF; parity violation in polarized ep scattering; and superconducting detector development.

53992 (DOE/ER/40427–25-N90) **Scalar and vector contributions to $\bar{p}p \to \bar{\Lambda}\Lambda$.** Alberg, M.A. (Seattle Univ., WA (USA). Dept. of Physics); Henley, E.M.; Wilets, L.; Kunz, P.D. Washington Univ., Seattle, WA (USA). Dept. of Physics. [1990]. 6p. Sponsored by U.S. DOE Energy Research. DOE Contract FG06-88ER40427. (CONF-900766–4: 1. biennial conference on low energy antiproton physics, Stockholm (Sweden), 2-6 Jul 1990). Order Number DE91001145. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

A quark model which includes both scalar and vector contributions to the reaction $\bar{p}p \to \bar{\Lambda}\Lambda$ is presented. DWBA calculations of differential cross sections, polarizations and spin correlation coefficients are compared to experimental results at several energies. The results are sensitive to details of the reaction mechanism and to the parameters of the $\bar{\Lambda}\Lambda$ interaction. 10 refs., 5 figs.

53993 (FNAL/C–90/163E) **CP violation experiment at Fermilab.** Hsiung, Yee B. The E-731 Collaboration. Fermi National Accelerator Lab., Batavia, IL (USA). Jul 1990. 20p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH03000. (CONF-9005233–6: 2. international conference on medium- and high-energy physics, Taipei (Taiwan), 8-18 May 1990). Order Number DE91000935. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The E731 experiment at Fermilab has searched for "direct" CP violation in $K^0 \to \pi\pi$, which is parametrized by ε'/ε. For the first time, in 20% of the data set, all four modes of the $K_{L,S} \to \pi^+\pi^-$ ($\pi^0\pi^0$) were collected simultaneously, providing a great check on the systematic uncertainty. The result is $Re(\varepsilon'/\varepsilon) = -0.0004 \pm 0.0014$ (stat) $\pm$ 0.0006(syst), which provides no evidence for "direct" CP violation. The CPT symmetry has also been tested by measuring the phase difference $\Delta\phi = \phi_{00} - \phi_\pm$ between the two CP violating parameters η_{00} and $\eta_\pm$. We fine $\Delta\phi = -0.3° \pm 2.4°$(stat) $\pm$ 1.2°(syst). Using this together with the world average $\phi_\pm$, we fine that the phase of the K^0-$\bar{K}^0$ mixing parameter ε is 44.5° $\pm$ 1.5°. Both of these results agree well with the predictions of CPT symmetry. 17 refs., 10 figs.

53994 (FNAL/C–90/166-E) **Multifractal structures in multiparticle production in $\bar{p}$-p interactions at $\sqrt{s}$ = 1800 GeV.** Rimondi, F. (Bologna Univ. (Italy)). CDF Collaboration. Fermi National Accelerator Lab., Batavia, IL (USA). Aug 1990. 7p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH03000. (CONF-9005245–3: International workshop on correlations and multiparticle production (CAMP), Marburg (Germany, F.R.), 14-16 May 1990). Order Number DE91001279. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

Fractal structure in multiparticle production of $\bar{p}$ – p "minimum-bias" interactions at $\sqrt{s}$ = 1800 GeV has been studied using the Collider Detector at Fermilab. Preliminary results are shown and compared with very simple Monte Carlo models.

53995 (FNAL/C–90/173) **Heavy flavor production in fixed-target experiments.** Appel, J.A. Fermi National Accelerator Lab., Batavia, IL (USA). Sep 1990. 19p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH03000. (CONF-9006268–5: 10. international conference on physics in collision, Durham, NC (USA), 21-23 Jun 1990). Order Number DE91001545. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

This presentation is a review of recent measurements on charm production at fixed-target experiments. The measurements are relevant to a number of basic physics issues: tests of perturbative QCD, fragmentation, and basic hadronic structure. We now have high quality, high statistics data from several fixed-target experiments. These include a total of about 30,000 fully reconstructed open charm decays and even more copious J/Ψ, Ψ, and Υ decays. Reconstruction of the full data is now reaching completion and we await final results for systematic physics interpretations. This review of the current situation will be followed by a brief look beyond, toward beauty production at fixed-target experiments.

53996 (FNAL/C–90-187-T) **Neutrino magnetic moment.** Chang, D. (Northwestern Univ., Evanston, IL (USA). Dept. of Physics and Astronomy); Senjanovic, G. Fermi National Accelerator Lab., Batavia, IL (USA). [1990]. 9p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH03000. (CONF-9003161–10: 25. Rencontres de Moriond on QCD and hadronic interactions conference, Les Arcs (France), 4-10 Mar 1990). Order Number DE91001542. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

We review attempts to achieve a large neutrino magnetic moment ($\mu_\nu \leq 10^{-11}\mu_B$), while keeping neutrino light or massless. The application to the solar neutrino puzzle is discussed. 24 refs.

53997 (FNAL/C–90/196-T) **Top quark mass spectrum from flavor-changing processes.** Albright, C.H. (Northern Illinois Univ., Dekalb, IL (USA). Dept. of Physics). Fermi National Accelerator Lab., Batavia, IL (USA). Sep 1990. 13p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH03000. (CONF-900822–11: 25. IUPAP international conference on high energy physics, Singapore (Singapore), 2-8 Aug 1990). Order Number DE91001781. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The input from flavor-changing processes is reviewed and results of several analyses are presented on the top quark mass spectrum without recourse to the neutral-current data. A top quark mass in the range 135 ± 25 GeV is much preferred, but a very massive top quark above 300 GeV can not be ruled out. Comments are made about the future use of the inclusive decay $B \rightarrow \gamma + X_{s=1}$ for constraining the top quark mass. 24 refs., 2 figs.

53998 (FNAL/C–90/205-E) **A quark-gluon plasma search in $\bar{p}$–p at $\sqrt{s}$ = 1.8 TeV.** Turkot, F. The E-735 Collaboration. Fermi National Accelerator Lab., Batavia, IL (USA). 8 Oct 1990. 7p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH03000. (CONF-900570–14: 8. international conference on ultrarelativistic nucleus-nucleus collisions: Quark Matter '90, Menton (France), 7-11 May 1990). Order Number DE91001784. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

The search by E-735 for QGP evidence in centrally produced particles in $\bar{p}p$ collisions has revealed several interesting results in the behavior with variation of $dN_c/d\eta$ in the measured interval from 2–18. In $\langle P_t \rangle$ we see a decrease in slope for all particles near $dN_c/d\eta \simeq 9$ corresponding to a Bjorken initial energy density of 2.2 GeV/fm^3. Above $dN_c/d\eta = 10$, the increase of $\langle P_t \rangle$ is small except for $\bar{p}$'s where the data suggest a 25% increase in the region 13–18. In the particle ratios, normalizing to π's, they (K, $\bar{p}$, Λ^0, γ) are all independent of $dN_c/d\eta$ within errors of ± 15% except for $K^\pm/\pi^\pm$ which increases by 30% in the interval 7 to 18. Based on the E-735 data analyzed to data, one can conclude that QGP is not manifest in $\bar{p}p$ collisions at 1.8 TeV. Nonetheless, there are the two effects mentioned above, which can be explored with much improved sensitivity using the high-statistics data of the '88–'89 run.

53999 (IPNO-T–9002) **Heavy mesons production study in the reaction antip + d → ^{3}He+X at an incident energy of 1450 MeV.** Loireleux, E. Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire; Paris-11 Univ., 91 - Orsay (France). Feb 1990. 118p. (In French). Order Number DE91716291. Source: NTIS (US Sales Only), PC A06/MF A01.

Study of heavy meson production in the antip + d →^{3} He + X reaction has been performed at the Laboratoire National Saturne synchrotron at 1450 MeV incident energy. The helium 3 particles have been detected by means of the SPES III spectrometer in an angular range between -0.2^0 and 21^0 and for momenta between 600 MeV/c and 1400 MeV/c. In the first part of this work, we give a summary of the different experimental and theoretical results already obtained on the subject during the last twenty years. The second part of this thesis is devoted to the description of the experimental set-up by which this experiment was conducted, that is the spectrometer, the two kinds of wires chambers, the trigger and the read-out electronics associated with each detector. The calibration of the different parts of the detection and the beam characteristics - intensity and polarization - is studied in the third part. There is also a discussion about the data reduction and then the extraction of results obtained with the help of two and three pion phase spaces simulations in the spectrometer. The results are presented in the last part of this work. The differential cross sections and the analyzing powers have been established for the centre of mass angles varying in step of 10 degrees for the mesons π^0, η and ω. A conclusion which indicates the prospects for a near future closes this thesis.

54000 (KEK–89-23, pp. 10-30) **ARGUS results on beauty and charm.** Schroeder, H. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Mar 1990. (CONF-8905220–: KEK topical conference on e^+e_- collision physics, Tsukuba (Japan), 17-19 May 1989). In *Proceedings of the KEK topical conference on e^+e^- collision physics.* 638p. Order Number DE90508150. Source: NTIS (US Sales Only), PC A99/MF A01.

Using the ARGUS detector at the e^+e^- storage ring DORIS II at DESY new results on beauty and charm physics have been obtained. With more data an update on B^0B-bar^0 mixing is given for the mixing parameter r = (21±6) %. The investigation of the decay B-bar^0 → $D^{*+}l^-\nu$ allows a determination of the Kobayashi-Maskawa element $|V_{cb}|$ = 0.052±0.011. The lifetime ratio of charged and neutral B mesons is measured to be $\tau B^+/\tau B^0$ = 1.00±0.23±0.14. In semileptonic B decays, as well as in exclusive B decays, no significant signals are found for b→u or b→s transitions. In charm physics, the spin of the D*(2459) is shown to be J=2. The enhancement, previously known as the D*(2420), seen in the final state $D^*(2010)^+\pi^-$, is resolved into two relatively narrow resonances separated in mass by approximately 40 MeV/c^2. The results of a decay angular analysis are in good agreement with the interpretation of the two states as L=1 D mesons of spin-parities 1$^+$ and 2$^+$. The charged isospin partner of the $D^*(2459)^0$ is observed at a mass of (2469±4±6) MeV/c^2, decaying to $D^0\pi^+$. The isospin mass splitting is measured to be (14±5±8) MeV/c^2. Finally, the first excited P-wave D_s meson has been observed in the decay $D^*_s(2536) \rightarrow D^{*+}K_s^0$. (author).

54001 (KEK–89-23, pp. 31-43) **CLEO results, CLEO II and CESR improvements.** Hartill, D.L. (Cornell Univ., Ithaca, NY (USA)). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Mar 1990. (CONF-8905220–: KEK topical conference on e^+e_- collision physics, Tsukuba (Japan), 17-19 May 1989). In *Proceedings of the KEK topical conference on e^+e^- collision physics.* 638p. Order Number DE90508150. Source: NTIS (US Sales Only), PC A99/MF A01.

Recent results from the analysis of CLEO data are presented along with a status report of the installation progress for the new CLEO II detector. The physics results include new results on B semileptonic decays, B to charm, and B to u decays. In addition, new results on D** and D_s decays are presented along with Υ(1S)→Ψ and other Upsilon decays. The installation of CLEO II is more than 80% complete with first operation with CESR expected by late summer 1989. CESR luminosity upgrade plans are given along with a schedule for that upgrade, called CESR Plus, to become operational. Recently, a modest effort has started at Cornell to design a B-factory with a peak luminosity in region of 10^{34} cm^{-2}sec^{-1}. Initial parameters for a symmetric energy storage ring design are given. (author).

54002 (KEK–89-23, pp. 173-204) **Recent results from hadron collider experiments.** Gladney, L.D. (Pennsylvania Univ., Philadelphia, PA (USA)). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Mar 1990. (CONF-8905220–: KEK topical conference on e^+e_- collision physics, Tsukuba (Japan), 17-19 May 1989). In *Proceedings of the KEK topical conference on e^+e^-*

collision physics. 638p. Order Number DE90508150. Source: NTIS (US Sales Only), PC A99/MF A01.

This paper presents preliminary results from the 1988 and 1989 runs of the UA2 and CDF experiments. The physics topics are primarily concentrated on measurements made on W and Z bosons and new mass limits for the top quark. (author).

54003 (KEK–89-23, pp. 214-260) **Recent results from AMY.** Kim, Guinyun (California Univ., Davis, CA (USA)). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Mar 1990. (CONF-8905220–: KEK topical conference on e^+e_- collision physics, Tsukuba (Japan), 17-19 May 1989). In *Proceedings of the KEK topical conference on e^+e^- collision physics.* 638p. Order Number DE90508150. Source: NTIS (US Sales Only), PC A99/MF A01.

Results from the AMY experiment at the TRISTAN e^+e^- collider are presented using a data sample of about 28 pb^{-1} at center of mass energies between 50 and 60.8 GeV. The measured value of R, which is about 2σ higher than the standard model expectation for c.m. energy above 56 GeV, is presented and several possible explanations are discussed. The results of the forward-backward asymmetry measurement of $e^+e^- \rightarrow$ bb-bar events, tests of QCD in the hadronic jets, and the search of heavy leptons are also presented. (author).

54004 (KEK–89-23, pp. 261-265) **Results from Nikko-Maru.** Kinoshita, K. (Harvard Univ., Cambridge, MA (USA)). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Mar 1990. (CONF-8905220–: KEK topical conference on e^+e_- collision physics, Tsukuba (Japan), 17-19 May 1989). In *Proceedings of the KEK topical conference on e^+e^- collision physics.* 638p. Order Number DE90508150. Source: NTIS (US Sales Only), PC A99/MF A01.

At the Nikko area of the TRISTAN storage ring the Search for Highly Ionizing Particles (SHIP) Nikko-Maru employs etchable solid state track detectors to search for heavily ionizing particles produced in the e^+e^- annihilations. New results are reported from exposures to 13.9 pb^{-1} integrated luminosity at $\sqrt{s}$=57-60.8 GeV. New upper limits are established on the production of Dirac monopoles with mass up to 28.8 GeV/c^2. (author).

54005 (KEK–89-23, pp. 266-285) **Results from TOPAZ.** Suzuki, Shiro (Nagoya Univ. (Japan). Dept. of Physics). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Mar 1990. (CONF-8905220–: KEK topical conference on e^+e_- collision physics, Tsukuba (Japan), 17-19 May 1989). In *Proceedings of the KEK topical conference on e^+e^- collision physics.* 638p. Order Number DE90508150. Source: NTIS (US Sales Only), PC A99/MF A01.

Recent results from TOPAZ at TRISTAN are reviewed placing emphasis on the origin of higher total hadronic cross section (R-ratio) than the standard model with 5 quark flavors above $\sqrt{s}$=56 GeV. Mass limits for top quark, b' quark (in both CC and FCNC decay modes), sequential heavy lepton and some of SUSY particles (e tilde, μ tilde, τ tilde, q tilde and χ tilde) are set thereby ruling out these as the origin of the high R values. The high R in the standard model implies Z^0 mass of around 90 GeV/c^2 which is lower than the world average quoted by PDG. In this context we explored the possibility of extra Z with either standard or smaller coupling in the mass region of sub to a few 100 GeV/c^2. (author).

54006 (KEK–89-23, pp. 286-311) **Results from VENUS.** Ogawa, K. (National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan)). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Mar 1990. (CONF-8905220–: KEK topical conference on e^+e_- collision physics, Tsukuba (Japan), 17-19 May 1989). In *Proceedings of the KEK topical conference on e^+e^- collision physics.* 638p. Order Number DE90508150. Source: NTIS (US Sales Only), PC A99/MF A01.

Recent results from VENUS experiments on e^+e^- reactions at energies between 52 and 60.8 GeV are presented. The R-values, the ratio of the total hadronic cross section to that of μ pair production, look slightly high within the present energy region. To understand this observation, a detailed study was carried out on the production of a heavy quark with —Q—=e/3. By using a next-to-leading log. approximation, the QCD cut-off parameter, Λ_{MS}, was obtained as being Λ_{MS}=208 MeV(+80MeV, -62MeV). The differential cross sections for $e^+e^- \rightarrow e^+e^-$, $\gamma\gamma$, $\mu^+\mu^-$, and $\tau^+\tau^-$ were found to be consistent with predictions of the standard model. The average charge asymmetry for $e^+e^- \rightarrow$ qq-bar was also measured and found to be consistent with the prediction of the standard model. No evidence was observed indicating new particle production. No single photon production was observed and the upper limit of the number of light neutrino types was set to be $N_\nu <$ 17.8 (90 % CL). (author).

54007 (KEK–89-23, pp. 333-359) **Higher order effects in EW standard model.** Igarashi, Masataka (Tokai Univ., Hiratsuka, Kanagawa (Japan). Dept. of Physics). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Mar 1990. (CONF-8905220–: KEK topical conference on e^+e_- collision physics, Tsukuba (Japan), 17-19 May 1989). In *Proceedings of the KEK topical conference on e^+e^- collision physics.* 638p. Order Number DE90508150. Source: NTIS (US Sales Only), PC A99/MF A01.

I state the renormalization scheme in the SU(2) x U(1) standard model adopted by the KEK group and present some of the results applied to various e^+e^- annihilation processes. Also reported is a systematic method proposed for the computational calculation of the two-loop corrections. (author).

54008 (KEK–89-23, pp. 360-383) **QCD and jets.** Munehisa, Tomo (Yamanashi Univ., Kofu (Japan). Faculty of Engineering). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Mar 1990. (CONF-8905220–: KEK topical conference on e^+e_- collision physics, Tsukuba (Japan), 17-19 May 1989). In *Proceedings of the KEK topical conference on e^+e^- collision physics.* 638p. Order Number DE90508150. Source: NTIS (US Sales Only), PC A99/MF A01.

We present a review on the parton shower in e^+e^- annihilation. Also we discuss the next-to-leading-logarithmic parton shower. We emphasize that this new model provides a useful tool for the determinations of Λ_{MS} from jet distributions. Analysis by the new model gives us Λ_{MS} = 0.235±0.052 GeV from data of PETRA, PEP and TRISTAN. (author).

54009 (KEK–89-23, pp. 419-436) **New physics with the present e^+e^- colliders.** Zeppenfeld, D. (Wisconsin Univ., Madison, WI (USA). Dept. of Physics). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Mar 1990. (CONF-8905220–: KEK topical conference on e^+e_- collision physics, Tsukuba (Japan), 17-19 May 1989). In *Proceedings of the KEK topical conference on e^+e^- collision physics.* 638p. Order Number DE90508150. Source: NTIS (US Sales Only), PC A99/MF A01.

The potential of the present e^+e^- machines TRISTAN, SLC, and, very soon, LEP to discover new physics is discussed. The production of new heavy particles would give the most striking signature but is severely constrained by data from hadron colliders. Special emphasis is given to the search for new contact interactions that may arise from the exchange of heavy bosons like leptoquarks or a second Z, or within the framework of composite models. (author).

54010 (KEK–89-23, pp. 457-504) **B-factories with e^+e^- colliders.** Coignet, G. (Grenoble-1 Univ., 74 - Annecy (France). Lab. de Physique des Particules). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Mar 1990. (CONF-8905220–: KEK topical conference on e^+e_- collision physics, Tsukuba (Japan), 17-19 May 1989). In *Proceedings of the KEK topical conference on e^+e^- collision physics.* 638p. Order Number DE90508150. Source: NTIS (US Sales Only), PC A99/MF A01.

Some considerations are recalled on the different approaches to studying b-physics. The potentialities of the various e^+e^- colliders in operation, proposed, or designed are then reviewed. Prospects for b-physics in the coming years are also given. (author).

54011 (PCCF-T–8908) **Inverse pion electroproduction at threshold $\pi^-p \rightarrow ne^+e^-$ and neutral pion Dalitz decay $\pi^0 \rightarrow \gamma e^+e^-$.** Fonvieille, H. Clermont-Ferrand-2 Univ., 63 - Aubiere (France). Lab. de Physique Corpusculaire; Clermont-Ferrand-2 Univ., 63 - Aubiere (France). Dec 1989. 73p. (In French). Order Number DE91716293. Source: NTIS (US Sales Only), PC A04/MF A01.

Inverse pion electroproduction at threshold (1) and neutral pion Dalitz decay (2) are investigated with stopped pions. The experiment uses the pion beam at the Saclay Linear Accelerator, a liquid hydrogen target, and a double-arm magnetic spectrometer for the lepton pair detection. A differential analysis yields the dynamics of processes (1) and (2), thus testing theoretical models for strong interaction at low energies. For process (1), a transverse-longitudinal-separation based on photon squared mass and polarization, gives a measurement of the s-wave multipoles: in relative (transverse electric) or absolute value (longitudinal multipole). Process (2) gives a measurement of the neutral pion electromagnetic transition form factor, and slope parameter.

54012 Mass limits of charged Higgs boson at large tanβ from e^+e^- annihilations at $\sqrt{s}$≈50–60.8 GeV. Smith, J.R.; McNeil, R.R.; Breedon, R.E.; Kim, G.N.; Ko, W.; Lander, R.L.; Maeshima, K.; Malchow, R.L.; Rowe, J.; Stuart, D.; Imlay, R.; Kirk, P.; Lim, J.; Metcalf, W.; Myung, S.S.; Cheng, C.P.; Gu, P.; Li, J.; Li, Y.K.; Ye, M.H.; Zhu, Y.C.; Abashian, A.;.The AMY Collaboration. *Physical Review, D (Particles Fields) (USA)*, 42(3): 949-951 (1 Aug 1990).

A search for the pair production of charged Higgs particles decaying via the $H^- \rightarrow \tau\bar{\nu}$ mode has been made in e^+e^- annihilations at center-of-mass energies between 50 and 60.8 GeV using the AMY detector at the KEK collider TRISTAN. No evidence for their existence is observed and 95%-C.L. mass limits are presented. The result has been interpreted in terms of the tanβ parameter in the Higgs sector.

6452 Particle Interactions and Properties - Theoretical

Refer also to citation(s) 53888, 53889, 53890, 53913, 53915, 53989, 54040, 54051, 54052, 54053, 54054, 54055, 54060, 54061, 54062, 54063, 54064, 54065

54013 (BNL–45237) **Theoretical perspective on RHIC [relativistic heavy ion collider] physics.** Dover, C.B. Brookhaven National Lab., Upton, NY (USA). Oct 1990. 9p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. (CONF-9009170–1: 10. international seminar on high energy physics problems, relativistic nuclear physics and quantum chromodynamics, Dubna (USSR), 24-29 Sep 1990). Order Number DE91001113. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

We discuss the status of the relativistic heavy ion collider (RHIC) project at Brookhaven, and assess some key experiments which propose to detect the signatures of a transient quark-gluon plasma (QGP) phase in such collisions. 24 refs.

54014 (CEA-CONF–10023) **Quarks, gluons and the spin of the proton.** Stern, J. CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Service de Physique Theorique. 1989. 10p. (CONF-8903175–: 24. Recontre de Moriond conference, Les Arcs (France), 12-17 Mar 1989). Order Number DE91716359. Source: NTIS (US Sales Only), PC A02/MF A01.

Experimentally, quark helicities do not seem to contribute to the proton spin. I shall show how this result can be obtained by a direct computation in a chiral field-theoretical model of quark and gluon confinement, taking gluon-exchange effects into account. At the same time, I shall get an estimate for the gluon-helicity contribution.

54015 (CEA-CONF–10080) **A new theory of collisions.** Giraud, B.G. CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Service de Physique Theorique. 1989. 15p. (CONF-8911150–: 6. international conference on recent progress in many body theories, Arad (Israel), 6-10 Nov 1989). Order Number DE91716374. Source: NTIS (US Sales Only), PC A03/MF A01.

Instead of diagonalizing the many-body Hamiltonian H, we invert E-H, where E is a complex energy, eventually real. All the traditional approximations to diagonalization can be adjusted to inversion. We specially investigate mean-field methods. This lecture gives a scheme for the detailed proofs of our arguments, already published, and lists several numerically soluble cases where our new method has been successfully tested for the calculation of collision amplitudes.

54016 (CNIC–00260) **On the possible types of elementary particles compatible with the canonical formulation.** Cheng Kaijia (Nanjing Univ., JS (China)). China Nuclear Information Centre, Beijing, BJ (China). Dec 1988. 11p. (NU–0003). Order Number DE91605321. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

In a paper 'Derivation of Dirac's Equation for a Free Particle' it was shown by the author that Dirac's equation can be deduced from a canonical formulation on the ground of relativity and quantum mechanics only. This idea will be further developed to a criterion on the possible forms of particles compatible with these formalism. It is shown in the text that only two types can exist in conformity with the criterion, namely fermions with spin 1/2 and scalars with spin zero. An example is given for a particle with spin unity to show that they do not fall into the present category. Particles that play roles in vector fields belong to different categories. Discussions are made for particles coupled with an external electronmagnetic field, preliminary results show that the essential features for the free particles still retain.

54017 (CNIC–00279) **The angular distribution for the process $e^+e^- \rightarrow J/\psi \rightarrow \gamma B(J^{PC})$, $B \rightarrow P_1P_2$ and the spin analysis of B.** Yan Wuguang (Academia Sinica, Beijing, BJ (China). Inst. of High Energy Physics); Yu Hong. China Nuclear Information Centre, Beijing, BJ (China). Oct 1988. 15p. (In English, Chinese). (BIHEP–0011). Order Number DE91605322. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

The authors have given the relation of the general helicity formalism (GHF) and the general effective interaction formalism (GEIF) for the process $e^+e^- \rightarrow J/\psi \rightarrow \gamma B(J^{PC}) \rightarrow P_1P_2$. The angular distributions for different spin of B indicate that there exist sensitive and insensitive regions to determine the spin of B. Unfortunately the current data of $\theta/f_2(1720)$ and ξ (2230) fall into the insensitive region.

54018 (CNIC–00282) **A discussion of contributions to the $0\nu\beta\beta$ decay from the pion-charge-exchange mechanisms.** Wu Huifang (Center of Theoretical Physics, CCAST (World Lab.), Beijing, BJ (China)); Song Hongqiu; Huang Tao. China Nuclear Information Centre, Beijing, BJ (China). 1989. 7p. (BIHEP–0012). Order Number DE91605323. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

The contributions to the amplitude of the $0\nu\beta\beta$ decay, mediated by the heavy neutrino, from the two kinds of pion-charge-exchange mechanisms were discussed. The point-double-exchange mechanism is much more important for the 0 $\nu\beta\beta$ decay in nuclei, compared to the point-single-exchange mechanism.

54019 (CNIC–00294) **Grand unified models including extra Z bosons.** Li Tiezhong (Academia Sinica, Beijing, BJ (China). Inst. of High Energy Physics). China Nuclear Information Centre, Beijing, BJ (China). Jan 1989. 12p. (BIHEP–0013). Order Number DE91605324. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

The grand unified theories (GUT) of the simple Lie groups including extra Z bosons are discussed. Under authors's hypothesis there are only SU_{5+m} SO_{6+4n} and E_6 groups. The general discussion of SU_{5+m} is given, then the SU_6 and SU_7 are considered. In SU_6 the $15+6^*+6^*$ fermion representations are used, which are not same as others in fermion content, Yukawa coupling and broken scales. A conception of clans of particles, which are not families, is suggested. These clans consist of extra Z bosons and the corresponding fermions of the scale. The all of fermions in the clans are down quarks except for the standard model which consists of Z bosons and 15 fermions, therefore, the spectrum of the hadrons which are composed of these down quarks are different from hadrons at present.

54020 (CNIC–00308) **Extra Z neutral bosons, families and heavy fermions.** Li Tiezhong (Academia Sinica, Beijing, BJ (China). Inst. of High Energy Physics). China Nuclear Information Centre, Beijing, BJ (China). Aug 1989. 6p. (BIHEP–0014). Order Number DE91605371. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

The minimal Grand Unified Theories with three-family should include two extra Z neufral bosons which belong to the different

broken scales. Georgi's argument on heavy Dirac fermions has been realized. These fermions should not be bizarre. The extra Z and Dirac fermions are not too heavy. The difficulty of the proton decay may be resolved.

54021 (DESY–90-090) **Angular correlations of 4 jets in e^+e^--annihilation: Asymmetries and the 3-gluon vertex.** Michelsen, D. (Hamburg Univ. (Germany, F.R.). 2. Inst. fuer Theoretische Physik). Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.). Jul 1990. 15p. Order Number DE91717063. Source: NTIS (US Sales Only), PC A03/MF A01.

We calculate the total and partial cross sections of the four-parton processes $e^+e^-\rightarrow\gamma$, $Z^0\rightarrow$qanti qgg and $e^+e^-\rightarrow\gamma$, $Z^0\rightarrow$qanti qqanti q in lowest order QCD perturbation theory. We study the partial cross sections with regard to the forward backward asymmetry. In addition we compare these cross sections to the cross sections of an abelian vector gluon model. (orig.).

54022 (FNAL/C–90/188-T) **The neutron electric dipole moment and the Weinberg mechanism.** Chang, D. (Northwestern Univ., Evanston, IL (USA). Dept. of Physics and Astronomy). Northwestern Univ., Evanston, IL (USA). Dept. of Physics and Astronomy. [1990]. 10p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH03000. (CONF-9003161–11: 25. Rencontres de Moriond on QCD and hadronic interactions conference, Les Arcs (France), 4-10 Mar 1990). Order Number DE91001541. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

We gave an overview of various mechanism for CP violation paying special attention to their prediction of the neutron electric dipole moment. The implication of the recent developments associated with the color electric dipole moment of gluon in various models of CP-violation are then critically assessed. 25 refs.

54023 (HD-PY–90/3) **Studies of jet production rates and tests of QCD on the Z^0 resonance.** Bethke, S. OPAL Collaboration. Heidelberg Univ. (Germany, F.R.). Physikalisches Inst. 1990. 7p. (CONF-900135–: 15. general meeting of the Division of Particles and Fields of the American Physical Society, Houston, TX (USA), 3-6 Jan 1990). Order Number DE91717162. Source: NTIS (US Sales Only), PC A02/MF A01.

Also presented at the 25. rencontre de Moriond (hadronic interactions), Les Arcs (France), Mar 1990.

Production rates of multijet hadronic final states of Z^0 boson decays are studied. They can be well described by analytic $O(\alpha_s^2)$ QCD calculations with parameters as determined at lower energies. The data cannot be described by an abelian, QED-like vector gluon model. The QCD parameters Asub(anti(MS)) and μ^2 are adjusted to describe the measured differential 2-jet invariant mass distribution. In second order QCD, including theoretical uncertainties due to the ambiguous choice of the renormalisation scale μ^2, the result is $\Lambda^{(5)}$sub(anti(MS)) = (80-450) MeV, which corresponds to $\alpha_s(M_Z{}^0) = 0.117 \pm 0.015$. Significant scaling violations are observed when the 3-jet fractions are compared to the corresponding results from smaller centre of mass energies, thus increasing, in good agreement with QCD, the evidence for a running coupling constant α_s. (orig.).

54024 (KEK–89-23, pp. 2-9) **Study of D_s decays.** Toki, W.H. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Mar 1990. (CONF-8905220–: KEK topical conference on e^+e_- collision physics, Tsukuba (Japan), 17-19 May 1989). In *Proceedings of the KEK topical conference on e^+e^- collision physics.* 638p. Order Number DE90508150. Source: NTIS (US Sales Only), PC A99/MF A01.

A limit for the absolute branching ratio of $BR(D_s \rightarrow \phi\pi) < 4.1$ % at 90 % C.L. and evidence for the decay $D_s \rightarrow f_0(975)\pi$ is presented from the Mark III. (author).

54025 (KEK–89-23, pp. 384-418) **Evidence indicating that meson and baryon formation are controlled by phase space and a linear confining quark potential.** Buchanan, C.D. (California Univ., Los Angeles, CA (USA). Dept. of Physics); Chun, S.-B. National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Mar 1990. (CONF-8905220–: KEK topical conference on e^+e_- collision physics, Tsukuba (Japan), 17-19 May 1989). In *Proceedings of the KEK topical conference on e^+e^- collision physics.* 638p. Order Number DE90508150. Source: NTIS (US Sales Only), PC A99/MF A01.

Using the relativistic string model for hadronization, we find that the two simple principles of longitudinal phase space on the hadron level and a linear confining quark potential as expressed by the 'Wilson Area Law' (a combination of principles from which the Lund Symmetric Fragmentation Function can be derived) describe a great deal of e^+e^- annihilation data without the need for the many (typically quark-level) parameters such as s/u, vector/All, qq/q, $(su/ud)/(s/u)$, $1/3(qq)_1/(qq)_0$, etc. that are commonly used. In particular, using only 2-3 parameters, we find good agreement with measured meson and baryon multiplicities and longitudinal distributions at E_{cm} = 29 GeV and at 10 GeV. Typically at 29 GeV a baryon and antibaryon are separated by ≈1.5 mesons in rank. Predictions are extrapolated to 60 GeV (TRISTAN) and 90 GeV (SLC/LEP). Further tests of the model are discussed. (author).

54026 (KEK–89-23, pp. 437-456) **Physics of the B system.** Sanda, A.I. (Rockfeller Univ., New York, NY (USA)). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Mar 1990. (CONF-8905220–: KEK topical conference on e^+e_- collision physics, Tsukuba (Japan), 17-19 May 1989). In *Proceedings of the KEK topical conference on e^+e^- collision physics.* 638p. Order Number DE90508150. Source: NTIS (US Sales Only), PC A99/MF A01.

We discuss a strategy for studying CP violation in the B system using the framework of the unitarity triangle. A special attention is placed on obtaining the parameters of the triangle with minimal of strong interaction ambiguities. Some aspects of rare B decays are also mentioned. (author).

54027 (LU-TP–89-17) **Effects of gluon radiation in hadronic collisions.** Gustafson, Goesta. Lund Univ. (Sweden). Dept. of Theoretical Physics. Oct 1989. 2p. (CONF-890903–: International Europhysics conference on high-energy physics, Madrid (Spain), 6-14 Sep 1989). Order Number DE91603047. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

In this talk I discuss effects of gluon emission in soft collisions, the so-called 'soft radiation' in the Fritjof model. It is seen e.g. that the pT in the fragmentation regions, the seagull effect, increases with energy in fair agreement with experiments. I also discuss the content of strange and heavier quarks in high-pT gluon jets. Within the dipole scheme for QCD cascades on finds a larger production of heavier quarks than in previous approaches. Qualitative agreement with data is obtained for the K/π ratio and D meson production.

54028 (PHE–86-13) **Proceedings of the 20. international symposium on the theory of elementary particles.** Akademie der Wissenschaften der DDR, Berlin-Zeuthen (German Democratic Republic). Inst. fuer Hochenergiephysik. Dec 1986. 405p. (CONF-8610472–: International symposium on the theory of elementary particles, Ahrenshoop (German Democratic Republic), 13-17 Oct 1986). Order Number DE91003001. Source: NTIS (US Sales Only), PC A18/MF A01; OSTI; INIS.

Individual papers are processed separately for the data base. (DLC)

54029 **Prospects for the study of gluonic states at BEPC.** Chanowitz, M.S. (Lawrence Berkeley Lab., CA (USA). Physics Div.). pp. 161-184 of Heavy flavor physics: Beijing Institute of modern physics series. Volume 1. Kuangta, C.; Chongshou, G.; Danhua, Q. World Scientific Pub. Co., Teaneck, NJ (USA) (1988). pp. 447 (CONF-8808182–: Beijing Institute of Modern Physics symposium on heavy flavor physics, Beijing (China), 10-20 Aug 1988).

Progress in the study of gluonic states depends crucially on accumulating data samples of order 10^{10} J/ψ decays, in order to perform complete partial wave analyses of radiative and hadronic J/ψ decays. This paper reports that this requirement is well matched to the capabilities of the Beijing Electrog-Positron Collider, which has approached the necessary luminosity in its first two months of operation.

54030 U(1) axial charge in the chiral limit. Ji Xiangdong (Center for Theoretical Physics). *Physical Review Letters (USA)*, 65(4): 408-411 (23 Jul 1990). DOE Contract AC02-76ER03099.

The U(1) axial-vector form factor is studied using an unsubtracted dispersion relation. The associated axial charge is shown to be analytic in quark masses in the chiral limit although individual terms in the Cheng-Li separation exhibit large isospin and flavor-SU(3) symmetry breaking. A new separation of the U(1) axial charge is proposed, based on the wave functions of the physical states entering in the spectral density.

54031 Charged-particle multiplicities in e^+e^- annihilations at $\sqrt{s}$ =50–61.4 GeV. Zheng, H.W.; Perez, P.; Auchincloss, P.; Blanis, D.; Bodek, A.; Budd, H.; Eno, S.; Fry, C.A.; Harada, H.; Ho, Y.H.; Kim, Y.K.; Kumita, T.; Mori, T.; Olsen, S.L.; Shaw, N.M.; Sill, A.; Thorndike, E.H.; Ueno, K.; Imlay, R.; Kirk, P.; Lim, J.; McNeil, R.R.; MThe AMY Collaboration. *Physical Review, D (Particles Fields) (USA)*, 42(3): 737-747 (1 Aug 1990).

We present the charged-particle multiplicity distributions for e^+e^- annihilation at center-of-mass energies from 50 to 61.4 GeV. The results are based on a data sample corresponding to a total integrated luminosity of 30 pb^{-1} obtained with the AMY detector at the KEK storage ring TRISTAN. The charged-particle multiplicity distributions deviate significantly from the modified Poisson and pair Poisson distributions, but follow Koba-Nielsen-Olesen scaling and are well reproduced by the LUND parton-shower model.

54032 ρ parameter constraints on fourth generation quark masses. Barger, V. (Wisconsin Univ., Madison, WI (USA). Dept. of Physics); Hewett, J.L.; Risso, T.G. *Modern Physics Letters A (USA)*, 5(10): 743-754 (20 Apr 1990).

Constraints on the masses of possible fourth generation quarks (a,v) are obtained from measurements of the ρ parameter and the elements of the quark mixing matrix. Stringent mass limits are found when the off-diagonal elements V_{tv} and V_{ab} are large. For example, with m_t = 90 GeV and $|V_{tv}| \simeq 0.5$ the authors find $m_{a,v} \leq 300$ GeV. Stronger constraints are obtained as m_t or $|V_{tv}|$ increase.

54033 Collider diffractive threshold, hadronic photons, and sextet quarks. Kang, K. (Department of Physics, Providence, RI (USA)); White, A.R. *Physical Review, D (Particles Fields) (USA)*, 42(3): 835-847 (1 Aug 1990). DOE Contract W-31-109-ENG-38 ;AC02-76ER03130.

We construct a simple dispersion-relation model to fit recent collider results on the total cross section and the elastic-amplitude real part. We find there should be a genuine physical threshold just below the CERN energy range. We suggest identifying this threshold with diffractive production of a new particle of mass ~30 GeV which may have been seen in mini-Centauro and Geminion cosmic-ray events. By assuming the existence of "strong-interaction" properties for high-energy photons this particle can be consistently identified as an η composed of color-sextet quarks. Geminions are then identified as two-photon decay via the anomaly. It seems plausible that most (if not all) cosmic-ray exotic events, including the strongly interacting photon, may be attributable to a strongly interacting color-sextet quark sector of QCD already proposed as the origin of the electroweak Higgs sector. We discuss how this sector should contribute to collider diffractive cross sections.

6453 Particle Invariance Principles and Symmetries

Refer also to citation(s) 53993, 54040, 54052, 54053, 54055, 54057, 54058, 54059, 54060, 54062, 54064, 54065, 54066, 54131, 54132, 54240

54034 (CONF-9007181–1) **New phases of D≥2 current and diffeomorphism algebras in particle physics.** Tze, Chia-Hsiung. Virginia Polytechnic Inst. and State Univ., Blacksburg, VA (USA). Sep 1990. 57p. Sponsored by U.S. DOE Energy Research. DOE Contract AS05-80ER10713. From 5. symmetries in science: algebraic structures, their representations, realizations and physical applications; Voralberg (Austria); 30 Jul - 3 aug 1990. Order Number DE91001515. Source: NTIS, PC A04/MF A01; OSTI; INIS; GPO Dep.

We survey some global results and open issues of current algebras and their canonical field theoretical realization in D $\geq$ 2 dimensional spacetime. We assess the status of the representation theory of their generalized Kac-Moody and diffeomorphism algebras. Particular emphasis is put on higher dimensional analogs of fermi-bose correspondence, complex analyticity and the phase entanglements of anyonic solitons with exotic spin and statistics. 101 refs.

54035 Quasi-exactly-solvable quantal problems: One-dimensional analogue of rational conformal field theories. Morozov, A.Y. (Inst. of Theoretical and Experimental Physics, B. Cheremushkinskaya ul. 25, 117259 Moscow (SU)); Perelomov, A.M.; Rosly, A.a.; Shifman, M.A.; Turbiner, A.V. *International Journal of Modern Physics A (USA)*, 5(4): 803-832 (20 Feb 1990).

The class of quasi-exactly-solvable problems in ordinary quantum mechanics discovered recently shows remarkable parallels with rational two-dimensional conformal field theories. This fact suggests that investigation of the quasi-exactly-solvable models may shed light on rational conformal field theories. The authors discuss a relation between these two theoretical schemes and propose a mathematical formulation for the procedure of constructing quasi-exactly solvable systems. This discussion leads us to a kind of generalization of the Sugawara construction.

54036 New experimental results for intermediate and high energy polarization asymmetry. Yokosawa, A. (High Energy Physics Div., Argonne National Lab., Argonne, IL (US)). *Modern Physics Letters B (USA)*, 5(16): 3089-3124 (20 Aug 1990). DOE Contract W-31-109-ENG-38.

The authors review recent experimental data on polarization asymmetry at intermediate and high energies. They include phenomenological interpretations of the data. In this review they examine the present status of polarization physics at intermediate and high energies. Special attention is directed to controversial experimental results as well as interpretations of the data. The authors objective is to contribute toward the planning of future experimental facilities and experiments.

6454 Field Theory

Refer also to citation(s) 53915, 53916, 54034, 54035, 54036, 54239, 54240, 54247, 54254, 54261

54037 (CBPF-NF–008/90) **Quantum instability of Minkowski spacetime.** Mazzitelli, F.D. (Instituto de Astronomia y Fisica del Espacio, Buenos Aires (Argentina)); Rodrigues, L.M.C.S. Centro Brasileiro de Pesquisas Fisicas (CBPF), Rio de Janeiro, RJ (Brazil). 1990. 14p. Order Number DE91604928. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

Taking into account vacuum fluctuations through a quadratic curvature term in the gravitational action, a minisuperspace model is constructed where the stability of Minkowsky spacetime is analyzed. (A.C.A.S.).

54038 (CTA-IEAv-RP–06/87) **The discrete spectrum for radiative transfer with polarization.** Garcia, R.D.M. (International Centre for Theoretical Physics, Trieste (Italy)); Siewert, C.E. Centro Tecnico Aeroespacial (CTA-IEAv), Sao Jose dos Campos, SP (Brazil). Inst. de Estudos Avancados. Feb 1987. 12p. Order Number DE91604929. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

Elementary considerations are used to define and analyze the discrete spectrum for a general radiative transfer model that includes polarization effects. (author).

54039 (DESY–90-092) **Shape of the constraint effective potential.** Goeckeler, M. (Technische Hochschule Aachen (Germany, F.R.). Inst. fuer Theoretische Physik); Leutwyler, H. Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.). Jul 1990. 36p. (HLRZ–90-054;BUTP–90-28). Order Number DE91717061. Source: NTIS (US Sales Only), PC A03/MF A01.

Using results from chiral perturbation theory for O(N)-symmetric models in the spontaneously broken phase, we study the distribution of the mean field vector $\Phi = V^{-1} \int d^dx$ vector $\phi(x)$ at large volume. We show that this distribution obeys a scaling law and we calculate the shape of the constraint effective potential in the scaling limit. (orig.).

54040 (DOE/ER/10713–10A) **[Theory of weak interactions and related topics; and study of e^+e^- interactions]: Progress report.** Chang, Lay Nam; Tze, C.H. Virginia Polytechnic Inst. and State Univ., Blacksburg, VA (USA). Dept. of Physics. [1990]. 29p. Sponsored by U.S. DOE Energy Research. DOE Contract AS05-80ER10713. Order Number DE91001369. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

This report contains brief discussions on the following topics: Higher point anomalous amplitudes; topological phase of quantum gravity; chiral symmetry breaking at finite temperature; Skyrmions as representations of current algebras; $D \geq 4$ critical phenomena: self-duality, infinite dimensional symmetries and hypercomplex analyticity; $D \geq 3$ topological field theories: anionic membranes and division algebras, geometric quantization by the method of orbits; and novel non-perturbative approaches. (LSP)

54041 (DOE/ER/40423–09-P90) **The dual description of long-distance QCD (Dual QCD).** Baker, M. Washington Univ., Seattle, WA (USA). Dept. of Physics. [1990]. 10p. Sponsored by U.S. DOE Energy Research. DOE Contract AS06-88ER40423. (CONF-9007180–1: 1990 international workshop on strong coupling gauge theories and beyond, Nagoya (Japan), 28-31 Jul 1990). Order Number DE91001140. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

We construct and solve a local field theory which describes in terms of dual variables a system having an A_μ propagator behaving like M^2/q^4 in the infrared and discuss how this theory can be used as a starting point for describing long-distance QCD. 3 refs.

54042 (DOE/ER/40423–10-P90) **Status of lattice field theory calculations.** Sharpe, S.R. Washington Univ., Seattle, WA (USA). Dept. of Physics. [1990]. 22p. Sponsored by U.S. DOE Energy Research. DOE Contract AS06-88ER40423. (CONF-9003221–1: PASCOS 90, Boston, MA (USA), Mar 1990). Order Number DE91001141. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

This report briefly discusses the following topics: overview of all present calculation; reliability criteria for quenched calculation; quenched versus full QCD, and difficulties facing full QCD; results for the quenched pion "wavefunction"; results for the quenched hadron spectrum; results for quenched B_K; A new method for calculating the surface tension; the non-pertubative upper bound on the Higgs mass; and toward the TERAFLOP machine.

54043 (IC–90/128) **Infinite-dimensional generalizations of finite-dimensional symmetries.** Fradkin, E.S. (International Centre for Theoretical Physics, Trieste (Italy)); Linetsky, V.Ya. International Centre for Theoretical Physics, Trieste (Italy). Jun 1990. 25p. Order Number DE91604930. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

Infinite-dimensional algebras associated with simple finite-dimensional Lie algebra g are considered. Generalizations of sl_2 are studied in detail. A manifest expression for the Virasoro-like generalization of D=3 conformal algebra so(3,2) is also presented. Application in higher spin theory and in conformal QFT are discussed. (author). 23 refs.

54044 (IC–90/130) **On generating functionals in algebraic quantum field theory. Fermion fields.** Sardanashvily, G.A. (International Centre for Theoretical Physics, Trieste (Italy)); Zakharov, O. International Centre for Theoretical Physics, Trieste (Italy). Jun 1990. 11p. Order Number DE91604931. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

In terms of algebraic field theory, generating functionals are described as forms on cummutative and anticommutative tensor algebras represented as algebras and Grassmann algebra-valued functions. (author). 13 refs.

54045 (IC–90/152) **Integrable theories and nonlinear conformal transformations.** Gorsky, A.S. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Teoreticheskoj i Ehksperimental'noj Fiziki); Selivanov, K.G. International Centre for Theoretical Physics, Trieste (Italy). Jul 1990. 7p. Order Number DE91604932. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

Hierarchies of integrable theories arise naturally in framework of nonlinear conformal transformations. The evolution equations may be interpreted either as one-parameter diffeomorphisms on Virasoro orbits or as transversal deformation of the orbits. Corresponding generators form a 2-loop algebra. (author). 12 refs.

54046 (IC–90/158) **On the quantum equivalence of antisymmetric tensor field theories.** Rivelles, V.O. (International Centre for Theoretical Physics, Trieste (Italy)); Sandoval, L. Jr. International Centre for Theoretical Physics, Trieste (Italy). Jun 1990. 8p. Order Number DE91604933. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

We show in a very simple way that the quantum equivalence of massless antisymmetric second rank tensor field theories with massless scalar and gauge theories in four and five dimensions, respectively. The technique can be straightforwardly extended to higher rank antisymmetric tensor fields. (author). 10 refs.

54047 (IFT-P–02/90) **Conformal field theory and representation of Kac-Moody and Virasoro algebras.** Ferreira, L.A. Instituto de Fisica Teorica (IFT), Sao Paulo, SP (Brazil). 1990. 42p. (In Portuguese). Order Number DE91604934. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

This work is related to the study of Kac-Moody and Virasoro algebras in Quantum Field Theory with conformal invariance in two-dimensions. (A.C.A.S.).

54048 (IFUSP-P–803) **Parafermionic conformal field theory.** Kurak, V. Sao Paulo Univ., SP (Brazil). Inst. de Fisica. Sep 1989. 14p. Order Number DE91604935. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

Conformal parafermionic field theories are reviewed with emphasis on the computation of their OPE estructure constants. It is presented a simple computational of these for the Z(N) parafermions, unveilling their Lie algebra content. (A.C.A.S.).

54049 (NBI-HE–90-29) **SU(2) gauge invariance in Hubbard models and superconductivity.** Oriand, P. (Niels Bohr Inst., Copenhagen (Denmark)). Niels Bohr Inst., Copenhagen (Denmark). Jun 1990. 15p. Source: Available from Niels Bohr Inst., Copenhagen (Denmark).

It is suggested that in doped copper oxide layers, the lowest energy p_x oxygen orbital for a hole is split by lattice distortions, into states which hybridize asymetrically with the dsub(x^2-y^2) orbitals on each of the neighboring copper atoms. The appropriate Hubbard model has two available sites associated with each oxygen atom. The system is effectively described by an SU(2) gauge theory, with an additional coupling to a charged spinning superfluid. Spin is thereby either confined or screened. Both possibilities lead to hole pairing and superconductivity. (orig.).

54050 (UFPB-DF–03/90) **Linearized fermion-gravitation system in a (2+1)-dimensional space-time with Chern-Simons data.** Mello, E.R.B. de. Paraiba Univ., Joao Pessoa, PB (Brazil). Dept. de Fisica. 1990. 13p. Order Number DE91604938. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

The fermion-graviton system at linearized level in a (2+1)-dimensional space-time with the gravitational Chern-Simons term is studied. In this approximation it is shown that this system presents anomalous rotational properties and spin, in analogy with the gauge field-matter system. (A.C.A.S.).

54051 **Z physics and tests of the Standard Model.** Cahn, R.N. (Lawrence Livermore National Lab., CA (USA)). pp. 1-69 of Heavy flavor physics: Beijing Institute of modern physics series. Volume 1. Kuangta, C.; Chongshou, G.; Danhua, Q. World Scientific Pub. Co., Teaneck, NJ (USA) (1988). pp. 447 (CONF-8808182–: Beijing Institute of Modern Physics symposium on heavy flavor physics, Beijing (China), 10-20 Aug 1988).

The fundamental aspects of Z physics are reviewed with an emphasis on e^+e^- annihilation. The effects of radiative corrections, both from ordinary QED and from the electroweak interactions are considered from an elementary point of view, but in some detail. The possibility of mixing with an extra Z boson is discussed. The implications for experiments are stressed. Additional information that will be obtained from measurements of the W in collider experiments is considered.

54052 Perspective on TeV-scale physics. Chanowitz, M.S. (Lawrence Berkeley Lab., CA (USA). Physics Div.). pp. 70-160 of Heavy flavor physics: Beijing Institute of modern physics series. Volume 1. Kuangta, C.; Chongshou, G.; Danhua, Q. World Scientific Pub. Co., Teaneck, NJ (USA) (1988). pp. 447 (CONF-8808182–: Beijing Institute of Modern Physics symposium on heavy flavor physics, Beijing (China), 10-20 Aug 1988).

This paper reviews theoretical motivations and experimental prospects for the study of TeV-scale physics. Three clues to the importance of TeV physics are discussed: Implications of quantum corrections for the masses of a fourth generation quark-lepton family, the gauge hierarchy problem and known solutions, implications of symmetry and unitarity for the symmetry-breaking sector of the electroweak gauge theory. The experimental prospects are reviewed with emphasis on the multi-TeV pp colliders that may be built on the 1990's. The topics include new phenomena that might occur-e.g., a fourth generation, heavy gauge bosons, composite structure, and supersymmetry-as well as the signals of the unknown $SU(2)_L \times U(1)_Y$ breaking mechanism that must occur within the TeV domain.

54053 The physics of heavy flavors. Gilman, F.S. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). pp. 185-234 of Heavy flavor physics: Beijing Institute of modern physics series. Volume 1. Kuangta, C.; Chongshou, G.; Danhua, Q. World Scientific Pub. Co., Teaneck, NJ (USA) (1988). pp. 447 DOE Contract AC03-76SF00515. (CONF-8808182–: Beijing Institute of Modern Physics symposium on heavy flavor physics, Beijing (China), 10-20 Aug 1988).

The primary aim of many of the theorists and experimentalists doing research in the area of heavy quark flavors is to search for physics that is beyond the standard model or which at least requires significant extensions of the standard model.

54054 Strong coupling QED and its possible relation to anomalous heavy-ion events. Ng, Y.J. (North Carolina Univ., Chapel Hill, NC (USA). Dept. of Physics and Astronomy). pp. 206-216 of New trends in strong coupling gauge theories. Bando, M.; Muta, T.; Yamawaki, K. World Scientific Pub. Co., Teaneck, NJ (USA) (1988). pp. 350 (CONF-8808309–: International workshop on new trends in strong coupling gauge theories, Nagoya (Japan), 24-27 Aug 1988).

The authors suggest that the e^+e^- peaks observed in heavy-ion collisions at GSI are due to the decay of a bound e^+e^- system formed in a new QED confining phase which is induced by the electromagnetic fields of the large-Z ions. The mass spectrum for this new positronium system with a linear- potential is discussed. The authors also present a qualitative analysis of the Schwinger-Dyson equation in the presence of a semi-realistic background field to see if there possibly exist background electromagnetic fields (hopefully like those in heavy-ion collisions) that can induce a phase transition in QED at relatively weak couplings. Unfortunately, the (constant and weak) background field in the authors' example does not seem to affect the QED critical coupling. Better approximations or some more realistic background fields may change the result.

54055 One-loop closed string 5-particle fermion amplitudes in the covariant formulation. Lin, Z.H. (Dept. of Physics and Astronomy, Univ. of Alabama, Tuscaloosa, AL (US)). *International Journal of Modern Physics A (USA),* 5(2): 299-328 (20 Jan 1990).

The closed superstring 2 fermion-3 boson and 4 fermion-1 boson scattering amplitudes at one-loop level are calculated in the covariant formulation. The authors use the method of Atick and Sen and find that it can be applied to 5 particles without any major difficulties. They discuss the symmetry properties of the amplitudes as a check of their correctness. From the residue of the relevant correlator for 4 fermion-1 boson scattering at the appropriate pole, the authors obtain the 2 fermion-2 boson amplitude which agrees with the amplitude calculated in the light-cone gauge in the Green-Schwarts formulation. The calculation requires some new θ-function identities and Fierz transformations in the ten dimensions which the authors also prove and discuss.

54056 Higher integrals of motion in a perturbed k = 1 SU(2) Wess-Zumino-Witten theory. Kobayashi, K.I. (Kyoto Univ. (Japan). Dept. of Physics); Uematsu, T. *Modern Physics Letters A (USA),* 5(11): 823-830 (10 May 1990).

The authors investigate higher integrals of motion in the k = 1 SU(2) Wess-Zumino-Witten (WZW) model perturbed by a certain relevant operator. While the perturbed system is a special case of a Sine-Gordon theory, it is shown to the lowest order in perturbation theory that there exist extra conserved currents due to the SU(2) symmetry in the original WZW model.

54057 Phase diagram of electroweak theory. Kapusta, J.I. (School of Physics, Minneapolis, (MN)). *Physical Review, D (Particles Fields) (USA),* 42(3): 919-925 (1 Aug 1990). DOE Contract FG02-87ER40328.

There is some controversy in the literature concerning the phase diagram of electroweak theory, particularly when *W*-boson condensation occurs. Problems with previous calculations are pointed out and the thermodynamic potential is recalculated. Limitations of current theoretical approaches are found and suggestions are made on how to improve the approximations, especially at high temperature and high density.

54058 Supersymmetry, Foldy-Wouthuysen transformation and stability of the dirac sea. Moreno, M. (Fermi National Accelerator Lab., Batavia, IL (USA)); Martinez, R.; Zentella, A. *Modern Physics Letters A (USA),* 5(12): 949-954 (20 May 1990).

It is shown that for a large class of potential problems in the Dirac equation the positive and negative energy solutions do not mix even in the strong coupling limit. The authors prove that this property, which implies a stability of the Dirac sea, is connected to the presence of superalgebra operators in the Dirac equation. The exact and closed form for the Foldy-Wouthuysen Hamiltonian which is used to prove this property are given. The potentials include the Dirac oscillator, the uniform time-independent magnetic field and the odd potentials and its non-abelian generalizations.

54059 de Sitter gravity and supergravity in three dimensions as Chern-Simons theories. Koehler, K. (Cincinnati Univ., OH (USA). Dept. of Physics); Mansouri, F.; Vaz, C.; Witten, L. *Modern Physics Letters A (USA),* 5(12): 935-941 (20 May 1990).

The authors construct a de Sitter supergravity theory in 2 + 1 dimensions as the Chern-Simons gauge theory of the supergroup OSp(1|2;C). The resulting action is a consistent classical supergravity theory with a positive cosmological constant. As in other three dimensional Chern-Simons theories, diffeomorphisms are shown to be equivalent to gauge transformations of OSp(1|;C) on shell. Consistency of the corresponding classical theory is discussed.

54060 Type 2 superstrings on twisted group manifolds and their heterotic counterparts. Fre, P. (Dept. of Physics, Univ. of California, Los Angeles, CA (US)); Ferrara, S. *International Journal of Modern Physics A (USA),* 5(6): 989-1024 (20 Mar 1990).

The authors construct Type II superstrings in four space-time dimensions compactified on a twisted Wess-Zumino-Witten model based on the group $SU(2)^3$. It is shown that within this framework, it is possible to obtain models with N = 6, 5 and 3 space-time supersymmetries, in addition to the usual models with N = 8, 4 and 2. The map of these models into the corresponding heterotic superstrings compactifications on six-dimensional manifolds also derived: in complete analogy to the compactifications on six-dimensional manifolds also in this case this map from Type II to heterotic superstrings corresponds geometrically to the embedding of the 9-dimensional compact manifold spin-connection into the gauge connection. The superstring compactifications the authors discuss are equivalent to asymmetric orbifold constructions in six-dimensions with no necessity, however, of introducing chiral bosons.

54061 Cosmic strings and baryon decay. Gregory, R. (N.A.S.A./Fermilab Astrophysics Center, Fermi National Accelerator Lab., Batavia, IL (US)). *Modern Physics Letters A (USA),* 5(16): 1235-1242 (10 Jul 1990).

The authors review the current literature on baryon decay catalysis by cosmic strings. They present a summary of the main arguments for decay catalysis.

54062 New bounds on the Higgs sector of minimal supersymmetric. Lopez, J.L. (Texas A and M Univ., College Station, TX

(USA). Dept. of Physics); Nanopoulos, D.V. *Modern Physics Letters A (USA),* 5(16): 1259-1264 (10 Jul 1990).

The authors examine the Higgs sector of the minimal supersymmetric extension of the standard model. The requirement of perturbative unification combined with the recent LEP data on Higgs boson searches, excludes substantial regions of parameter space. They find that only $0.42 \leq \tan\beta \lesssim 0.76$ and $\tan\beta \gtrsim 1.30$ are the allowed values for $\tan\beta = v_2/v_1$. They also determine the absolute lower bound on the lightest Higgs mass to be $\approx$8 GeV. They conclude that improved lower bounds on the top quark mass and/or the standard model Higgs boson mass will impose yet more stringent constraints on the model. These results clearly favor $\tan\beta > 1$, in agreement with N = 1 supergravity or superstring-inspired models.

54063 Formation of composite Higgs bosons from quark-antiquarks at lower energy scales. Suzuki, M. (Dept. of Physics and Lawrence Berkeley Laboratory, University of California, Berkeley, CA (US)). *Modern Physics Letters A (USA),* 5(15): 1205-1211 (20 Jun 1990).

The authors study how the simple predictions of the Nambu-Jona-Lasinio model of composite Higgs bosons are modified when quark interactions more singular than the nonderivative four-quark interaction are added. The t-quark mass is no longer restricted to $\gtrsim$200 GeV, the simple mass relation between the t-quark and the scalar Higgs boson is lost, and the energy scale of the quark couplings can be chosen as low as the authors wish. Implications in experimental testability of this class of models are discussed.

54064 Zero energy gauge fields and the phases of a gauge theory. Guendelman, E.I. (Theoretical Div., MS B285, Los Almos National Lab., Los Almos, NM (US)). *Modern Physics Letters B (USA),* 5(14): 2783-2798 (20 Jul 1990).

A new approach to the definition of the phases of a Poincare invariant gauge theory is developed. It is based on the role of gauge transformations that change the asymptotic value of the gauge fields from zero to a constant. In the context of theories without Higgs fields, this symmetry can be spontaneously broken when the gauge fields are massless particles, explicitly broken when the gauge fields develop a mass. Finally, the vacuum can be invariant under this transformation, this last case can be achieved when the theory has a violent infrared behavior, which in some theories can be connected to a confinement mechanism.

54065 Axigluon signals at e^+e^- colliders. Novaes, S.F. (Theoretical Physics Group, Physics Div., Lawrence Berkeley Lab., Berkeley, CA (US)); Raychaudhuri, A. *Modern Physics Letters B (USA),* 5(14): 2769-2782 (20 Jul 1990).

A massive gauge boson-the axigluon-is predicted in theories with chiral color. If it is not very heavy then it may be possible to produce the axigluon at the upcoming e^+e^- accelerators. The authors examine the detectability of a quark, antiquark, axigluon final state through and analysis of the thrust distributions.

54066 Euclidean Wilson loop and axial gauge. Nardelli, G. (Center of Theoretical Physics, Lab. of Nuclear Science and Dept. of Physics, Massachusetts Inst. of Technology, Cambridge, MA (US)); Soldati, R. *Modern Physics Letters B (USA),* 5(16): 3171-3192 (20 Aug 1990).

A critical analysis is given in order to set up a well-defined perturbative expansion for Yang-Mills Euclidean theories within the axial gauge choice, using Cauchy principal value prescription to handle the spurious singularities. It is shown that, following a mathematically meaningful and unambiguous procedure, the exponential behavior of the Euclidean Wilson loop does not occur at variance with the covariant and planar gauge choices. A comparison with previous similar approaches and results is worked out in order to clearly understand the reasons for the breakdown of gauge invariance in the present case. The authors conclude that the so far proposed alternative prescriptions, which have been claimed to restore gauge invariance, should be carefully reexamined, at least for the Euclidean formulation.

65 PHYSICS II

Refer also to citation(s) 54399

6510 Nuclear Physics

Refer also to citation(s) 52905, 53500, 53526, 54420

54067 (BNL–45178) **Forecasting catastrophe by exploiting chaotic dynamics.** Stewart, H.B.; Lansbury, A.N. Brookhaven National Lab., Upton, NY (USA). [1990]. 25p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. (CONF-901246–2: EPRI workshop on applications of chaos, San Francisco, CA (USA), Dec 1990). Order Number DE91001118. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Our purpose here is to introduce a variation on the theme of short term forecasting from a chaotic time series. We show that for the lowest-dimensional chaotic attractors, it is possible to predict incipient catastrophes, or crises, by examining time series data taken near the catastrophic bifurcation threshold, but always remaining on the safe side of the threshold.

54068 (CNIC-I–004, pp. 26-27) **Competition between transfer and fragmentation reactions induced by 14.7 and 19.2 MeV/u ^{20}Ne ions.** Hu Xiaoqing (and others); Zhu Yongtai; Li Songlin. China Nuclear Information Centre, Beijing, BJ (China); Academia Sinica, Lanzhou, GS (China). Inst. of Modern Physics. Jun 1990. In *IMP annual report, 1988 (January-December).* 138p. Order Number DE91606195. Source: NTIS (US Sales Only), PC A07/MF A01; OSTI; INIS.

Published in summary form only. NICKEL 58 TARGET/neon 20 reactions; NUCLEAR FRAGMENTATION/neon 20 beams; TRANSFER REACTIONS/neon 20 beams; DISTRIBUTION; EXCLUSIVE INTERACTIONS; EXPERIMENTAL DATA; INCLUSIVE INTERACTIONS; KVI CYCLOTRON; VELOCITY

54069 (CNIC-I–004, pp. 28-29) **'Uncorrelated' coincidence between α-particles and projectile-like fragments reactions induced by ^{20}Ne (14.7, 19.2 MeV/u)^7.** Hu Xiaoqing (and others); Zhu Yongtai; Li Songlin. China Nuclear Information Centre, Beijing, BJ (China); Academia Sinica, Lanzhou, GS (China). Inst. of Modern Physics. Jun 1990. In *IMP annual report, 1988 (January-December).* 138p. Order Number DE91606195. Source: NTIS (US Sales Only), PC A07/MF A01; OSTI; INIS.

Published in summary form only. ALPHA PARTICLES/coincidence methods; NICKEL 58 TARGET/neon 20 reactions; NUCLEAR FRAGMENTS/coincidence methods; CROSS SECTIONS; EXPERIMENTAL DATA; KVI CYCLOTRON; NEON 20 BEAMS

54070 (CNIC-I–004, pp. 33-34) **Absorptive breakup of projectile in ^{12}C + ^{64}Ni reaction.** Fan Zhiguo; Zheng Jiwen; Liang Guozhao; Bai Xiping; Liu Guoxing; Chen Keliang; Wang Sufang; Yu Xian. China Nuclear Information Centre, Beijing, BJ (China); Academia Sinica, Lanzhou, GS (China). Inst. of Modern Physics. Jun 1990. In *IMP annual report, 1988 (January-December).* 138p. Order Number DE91606195. Source: NTIS (US Sales Only), PC A07/MF A01; OSTI; INIS.

Published in summary form only. NICKEL 64 TARGET/carbon 12 reactions; NUCLEAR FRAGMENTS/angular distribution; NUCLEAR FRAGMENTS/energy spectra; BREAKUP REACTIONS; MEV RANGE 10-100; NUCLEAR FRAGMENTATION; PROJECTILES

54071 (CNIC-I–004, pp. 45-46) **Measurement of total reaction cross sections for neutron-rich and proton-rich nuclei.** Zhan Wenlong (and others); Mittig, W.; Villari, A.C.C. China Nuclear Information Centre, Beijing, BJ (China); Academia Sinica, Lanzhou, GS (China). Inst. of Modern Physics. Jun 1990. In *IMP annual report, 1988 (January-December).* 138p. Order Number DE91606195. Source: NTIS (US Sales Only), PC A07/MF A01; OSTI; INIS.

Published in summary form only. NEUTRON-RICH ISOTOPES/total cross sections; NUCLEI/total cross sections; COPPER; CORRECTIONS; EFFICIENCY; ENERGY DEPENDENCE; EXPERIMENTAL DATA; NUCLEI; PROTONS; SILICON

54072 (CNIC-I–004, pp. 69-70) **The reaction cross-section measurement for 17 nucleus with 14.7 MeV neutron.** Tian

Yuhong; Pepelink, R. China Nuclear Information Centre, Beijing, BJ (China); Academia Sinica, Lanzhou, GS (China). Inst. of Modern Physics. Jun 1990. In *IMP annual report, 1988 (January-December)*. 138p. Order Number DE91606195. Source: NTIS (US Sales Only), PC A07/MF A01; OSTI; INIS.

Published in summary form only. NEUTRON REACTIONS/cross sections; COPPER ISOTOPES; EXPERIMENTAL DATA; MEV RANGE 10-100; TIN ISOTOPES; ZINC ISOTOPES

54073 (CONF-900726–4) **Spin effects in the weak interaction.** Freedman, S.J. (Argonne National Lab., IL (USA)). Argonne National Lab., IL (USA). [1990]. 26p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From International conference on polarization phenomena in nuclear physics; Paris (France); 9-13 Jul 1990. Order Number DE91001295. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Modern experiments investigating the beta decay of the neutron and light nuclei are still providing important constraints on the theory of the weak interaction. Beta decay experiments are yielding more precise values for allowed and induced weak coupling constants and putting constraints on possible extensions to the standard electroweak model. Here we emphasize the implications of recent experiments to pin down the strengths of the weak vector and axial vector couplings of the nucleon.

54074 (DOE/ER/40343–4) **Research in experimental nuclear physics: Progress report March 1, 1987–September 30, 1990.** Moore, C.F. Texas Univ., Austin, TX (USA). Dept. of Physics. Sep 1990. 44p. Sponsored by U.S. DOE Energy Research. DOE Contract FG05-87ER40343. Order Number DE91001616. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

This paper discusses the following topics; Pion scattering from a polarized target; pion elastic, inelastic scattering, and pion absorption; pion DCX studies; coincidence measurements; isospin splitting of the giant dipole built on the isobaric analog state; pion DCX above the $\Delta_{3/2,3/2}(1232)$ resonance; pion scattering from polarized ^{13}C target; 6^- stretched configuration on ^{32}S; and, energy dependence of the pion absorption cross section on ^{12}C.

54075 (IAEA-NDS–97(Rev.0)) **ENDF/B-III scattering law library.** Goulo, V.; Lemmel, H.D. International Atomic Energy Agency, Vienna (Austria). Nuclear Data Section. Dec 1989. 219p. Order Number DE91601236. Source: NTIS (US Sales Only), PC A10/MF A01; OSTI; INIS.

This library contains scattering law data $S(\alpha,\beta)$ for 10 materials used for thermal reactor and shielding calculations: H_2O, D_2O, Be, BeO, C, CH_2, C_6H_6, UO_2, ZrH_x (for H), ZrH_x (for Zr) for temperatures from 296 to 1000 or 1200 deg. K. Data are in ENDF/B-3 format. The library is available from the IAEA Nuclear Data Section on magnetic tape, costfree upon request. (author). Figs and tabs.

54076 (IAEA-NDS–115(Rev.0)) **Prompt gamma-rays from thermal-neutron capture.** Lone, M.A. (Atomic Energy of Canada Ltd., Chalk River, ON (Canada). Chalk River Nuclear Labs.); Leavitt, R.A.; Harrison, D.A.; Lemmel, H.D. (ed.). International Atomic Energy Agency, Vienna (Austria). Nuclear Data Section. Apr 1989. 8p. Order Number DE91601231. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

This document describes format and contents of a nuclear data library on magnetic tape which lists prompt gamma rays from thermal-neutron capture evaluated by M.A. Lone et al. The magnetic tape is available, costfree, from the IAEA Nuclear Data Section. (author).

6511 Experimental Techniques

Refer also to citation(s) 54367

54077 (NEANDC–259-U) **Proceedings of a specialists' meeting on neutron activation cross sections for fission and fusion energy applications.** Wagner, M. (Vienna Univ. (AT). Inst. fuer Radiumforschung und Kernphysik); Vonach, H. Nuclear Energy Agency, 75 - Paris (France). 1990. 351p. (CONF-890982–: Specialists' meeting on neutron activation cross sections for fission and fusion energy applications, Argonne, IL (USA), 13-15 Sep 1989). Order Number DE91716261. Source: NTIS (US Sales Only), PC A16/MF A01.

These proceedings of a specialists' meeting on neutron activation cross sections for fission and fusion energy applications are divided into 4 sessions bearing on: - data needs: 4 conferences - experimental work: 11 conferences - theoretical work: 4 conferences - evaluation work: 5 conferences.

54078 (NEANDC–259-U, pp. 285-292) **Present status of the JENDL activation file.** Nakajima, Y. (Japan Atomic Energy Research Inst. Tokai, Ibaraki (JP)). Nuclear Energy Agency, 75 - Paris (France). 1990. (CONF-890982–: Specialists' meeting on neutron activation cross sections for fission and fusion energy applications, Argonne, IL (USA), 13-15 Sep 1989). In *Proceedings of a specialists' meeting on neutron activation cross sections for fission and fusion energy applications.* 351p. Order Number DE91716261. Source: NTIS (US Sales Only), PC A16/MF A01.

Evaluation on activation cross section data for the JENDL activation file was started two years ago. Since there are already big activation libraries in western Europe and in the United States, we are aiming at more accurate evaluation of important reactions to applications to fission and fusion reactors rather than aiming at as many reactions as in these big libraries. About 1,000 reaction cross sections have been evaluated for 37 most important elements up to 20 MeV. In this fiscal year we are going to evaluate about 1,000 reactions of 22 elements designated as the second priority. The JENDL activation file will be finalized by March 1991.

54079 (NEANDC–259-U, pp. 293-307) **A simultaneous evaluation of some important cross sections at 14.70 MeV.** Ryves, T.B. (Commission of European Communities Geel (BE). Central Bureau for Nuclear Measurements). Nuclear Energy Agency, 75 - Paris (France). 1990. (CONF-890982–: Specialists' meeting on neutron activation cross sections for fission and fusion energy applications, Argonne, IL (USA), 13-15 Sep 1989). In *Proceedings of a specialists' meeting on neutron activation cross sections for fission and fusion energy applications.* 351p. Order Number DE91716261. Source: NTIS (US Sales Only), PC A16/MF A01.

A simultaneous evaluation of the $^{27}Al(n,\alpha)$, $^{56}Fe(n,p)$, $^{63}Cu(n,2n)$, $^{65}Cu(n,2n)$, $^{197}Au(n,2n)$, $^{93}Nb(n,2n)$, $^{32}S(n,p)$, $^{1}H(n,n)$, $^{27}Al(n,p)$, $^{59}Co(n,\alpha)$, $^{235}U(n,f)$ and $^{238}U(n,f)$ cross sections at an energy of 14.70 MeV has yielded a consistent set with uncertainties (1-σ) of 0.5 - 1.5% together with a correlation matrix. The large number of experimental results included were either ratio measurements or 'absolute' measurements relying on neutron fluences determined by the associated particle technique. The method of weighted least-squares, taking into account correlations, was used in the simultaneous evaluation. Good agreement was found with several recent evaluations.

54080 **Limits on fourth family neutrinos from searches for beta-beta decay and dark matter.** Caldwell, D.O. (California Univ., Los Angeles (USA)). *Annals of the New York Academy of Sciences (USA)*, 578: 123-130 (Dec 1989). (CONF-8902110–: 2. international symposium on the fourth family of quarks and leptons, Santa Monica, CA (USA), 23-25 Feb 1989).

Nonaccelerator experiments searching for neutrinoless double beta decay and for dark matter are briefly discussed. The theory of fourth family leptons is addressed as it pertains to both double beta decay and dark matter. Experimental findings on dark matter WIMPs are summarized. 23 refs.

6512 Nuclear Properties and Reactions, A = 1-5, Experimental

Refer also to citation(s) 54366

54081 (CEA-CONF–10071) **Exclusive experiments on few nucleon systems at Saclay.** Legoff, J.M. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Service de Physique Nucleaire a Haute Energie); Magnon, A.; Bernheim, M.; Gerard, A.; Marchand, C.; Morgenstern, J.; Picard, J.; Reffay, D.; Turck-Chieze, S.; Vernin, P.;CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Service de Physique Nucleaire a Haute Energie. 1989. 10p. (CONF-8905232–: 4. workshop on perspectives in nuclear physics at intermediate energies, Trieste

(Italy), 8-12 May 1989). Order Number DE91716201. Source: NTIS (US Sales Only), PC A02/MF A01.

The transverse and longitudinal responses for the $^4He(e,e'p)^3H$ reaction have been separated in the low missing momentum region. The transverse spectral function agrees with theory whereas the longitudinal spectral function is low by 30%. The $^4He(e,e'p)X$ reaction was studied at high missing momenta. The continuum cross-section (X = ^2H,n and X = pnn) dominates over the two-body break-up (X = ^3H) for $p_m > 300$ MeV/c. Moreover, this continuum cross-section has a characteristic structure that reveals an effect of short-range correlation between two nucleons.

6513 Nuclear Properties and Reactions, A = 6-19, Experimental

Refer also to citation(s) 53470

54082 (CENBG–9001) **Nuclear reactions and electromagnetic dissociation of ^{8,9,11}Li 100 MeV/nucleon.** Hubert, F. (Bordeaux-1 Univ., 33 - Gradignan (FR). Centre d'Etudes Nucleaires); Bazin, D.; Del Moral, R.; Dufour, J.P.; Fleury, A.; Blank, B.; Gaimard, J.J.; Geissel, H.; Schmidt, K.H.; Stelzer, H.; Summerer, K.; Clerc, H.G.; Hanelt, E.; Steiner, M.; Voss,Bordeaux-1 Univ., 33 - Gradignan (France). Centre d'Etudes Nucleaires. 1990. 15p. (CONF-9001120–: 18. International Winter Meeting on Nuclear Physics, Bormio (Italy), 22-26 Jan 1990). Order Number DE91716323. Source: NTIS (US Sales Only), PC A03/MF A01.

Measurements of nuclear reaction and electromagnetic dissociation cross-sections have been performed at SATURNE with secondary beams of^{8}Li, ^{9}Li, ^{11}Li interacting with C, Al, Cu, Sn, Pb targets at energies around 100 MeV/n. The detection method relies on beta-decay characteristics, energy-loss, total energy and range measurements.

54083 (CNIC–00071) **Evaluation of tritium production cross-section for neutron-interaction with ^{7}Li.** Yu Baosheng (Academia Sinica, Beijing, BJ (China). Inst. of Atomic Energy); Cai Dunjiu. China Nuclear Information Centre, Beijing, BJ (China). 1987. 9p. (In Chinese). (CNDC–0001). Order Number DE91605484. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

The ^{7}Li(n, n't) α reaction cross-section has been evaluated and recommended. These experimental data were selected up to the end of 1986, in which main microscopic nuclear data and benchmark measurements were included. These data are retrieved from EXFOR master files of International Atomic Energy Agency, and new information is added in which IAE (the Chinese Institute of Atomic Energy) experimental results is considered.

54084 (IFUSP-P–809) **Radii of radioactive nuclei.** Mittig, W. (Grand Accelerateur National d'Ions Lourds (GANIL), 14 - Caen (France)); Plagnol, E.; Schutz, Y. Sao Paulo Univ., SP (Brazil). Inst. de Fisica. Nov 1989. 12p. Order Number DE91605485. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

A new simple direct method for the measurement of the total reaction cross section (σ_R) for several light radioactive nuclei (A<40) is developed. From that, the reduced strong absorption radii (r_o^2) are obtained. A comparison is made with data obtained by other techniques. A strong isospin dependence of the nuclear radii is observed. (L.C.).

54085 Simulations of dynamic pion production in 60 and 200 GeV collisions of ^{16}O + ^{197}Au. Wilson, J.R. (Lawrence Livermore National Lab., Livermore, CA (US)); Mcabee, T.L.; Alonso, C.T. *International Journal of Modern Physics A (USA)*, 5(3): 543-558 (10 Feb 1990).

The authors have investigated collision of ^{16}O with ^{197}Au at bombarding energies of 60 and 200 GeV/N in the laboratory frame. Their hydrodynamics-based 3-D model, with a modified gamma-law equation of state, includes detailed dynamic pion production and propagation. A comparison of hydrodynamic simulations with and without the inclusion of pions shows that including the pion channel yields results which more closely reproduce the experimental data. The authors show direct comparisons of several predicted observables with experimental measurements made over various pseudorapidity ranges. In general, they find that while their overall energy agreement with calorimetry experiments is good, and their predicted spatial distributions are in fair agreement with experimental data, their model produces pions which are to energetic and too few in balancing proportions. The authors results indicate that most of the emitted (measured) pions emerge from the cooler surface, and not from the hot, dense interior of the hadronic composite.

6514 Nuclear Properties and Reactions, A = 20-38, Experimental

Refer also to citation(s) 54084, 54121

54086 (CENBG–8925) **Study of Ne and Kr production in Mg, Al, Rb, Sr and Y targets by 0-180 MeV neutrons. Cosmochemical application.** Bertin, P. Bordeaux-1 Univ., 33 - Gradignan (France). Centre d'Etudes Nucleaires; Bordeaux-1 Univ., 33 (France). Jul 1989. 115p. (In French). Order Number DE91716292. Source: NTIS (US Sales Only), PC A06/MF A01.

High sensitivity mass spectrometry technique has been used to measure production of noble gases Ne and Kr induced by 0-180 MeV neutrons in Mg, Al, Rb, Sr and Y targets. This experiment allowed us an evaluation of the implied excitation functions, in an energy range where no experimental data were available. These results have exhibited the importance of secondary neutrons induced in the interaction of cosmic rays with meteorites and moon surface.

54087 (CNIC-I–004, pp. 38-39) **Evaporation decay following the ^{32}S + ^{24,25,26}Mg fusion reaction.** Cavallareo, S.L. (South Laboratory, INFN (Italy)); Sperduto, M.L.; Luo Yixiao. China Nuclear Information Centre, Beijing, BJ (China); Academia Sinica, Lanzhou, GS (China). Inst. of Modern Physics. Jun 1990. In *IMP annual report, 1988 (January-December)*. 138p. Order Number DE91606195. Source: NTIS (US Sales Only), PC A07/MF A01; OSTI; INIS.

Published in summary form only. MAGNESIUM 24 TARGET/sulfur 32 reactions; MAGNESIUM 25 TARGET/sulfur 32 reactions; MAGNESIUM 26 TARGET/sulfur 32 reactions; MULTIPLICITY/heavy ion fusion reactions; EVAPORATION MODEL; EXPERIMENTAL DATA; IN-BEAM SPECTROSCOPY; MULTIPLICITY; NUCLEAR DECAY; STATISTICAL MODELS; TANDEM ELECTROSTATIC ACCELERATORS

54088 (CNIC-I–004, pp. 42-43) **Onset of multifragmentation in central collisions of ^{40}Ar on ^{27}Al, from 25 to 65 MeV/u.** Jin Genming. China Nuclear Information Centre, Beijing, BJ (China); Academia Sinica, Lanzhou, GS (China). Inst. of Modern Physics. Jun 1990. In *IMP annual report, 1988 (January-December)*. 138p. Order Number DE91606195. Source: NTIS (US Sales Only), PC A07/MF A01; OSTI; INIS.

Published in summary form only. ALUMINIUM 27 TARGET/argon 40 reactions; MULTIPLICITY/charged particles; CENTER-OF-MASS SYSTEM; COLLISIONS; DISTRIBUTION; EXCITATION FUNCTIONS; EXPERIMENTAL DATA; IMPACT PARAMETER; MULTIPLICITY; NUCLEAR FRAGMENTATION

54089 (IFUSP-P–829) **Back-angle anomaly and coupling between seven reaction channels of ^{12}C+^{24}Mg using algebraic scattering theory.** Lepine-Szily, A.; Obuti, M.M.; Lichtenthaeler Filho, R.; Oliveira Junior, J.M.; Villari, A.C.C. Sao Paulo Univ., SP (Brazil). Inst. de Fisica. Mar 1990. 18p. Order Number DE91605493. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

We measured six fairly complete angular distributions of elastic, inelastic and α-transfer reactions of the ^{12}C+^{24}Mg system ar E_{cm} = 25.2 MeV. We performed coupled channels calculations using the Algebraic Scattering Theory with nuclear algebraic potential derived from nuclear phase shifts and using available structure informations for the inelastic coupling strengths. The back angle rise in the elastic cross section is fully explained by the couplings between elastic and transfer channels. (author).

54090 (NEANDC–259-U, pp. 19-28) **The role of sequential (x,n) reactions on element activation of fusion reactor materials and related nuclear data needs.** Cierjacks, S. (Kernforschungszentrum Karlsruhe, G.m.b.H. (DE). Inst. fuer Material - und Festkoerperforschung); Hino, Y. Nuclear Energy Agency, 75 -

Paris (France). 1990. (CONF-890982–: Specialists' meeting on neutron activation cross sections for fission and fusion energy applications, Argonne, IL (USA), 13-15 Sep 1989). In *Proceedings of a specialists' meeting on neutron activation cross sections for fission and fusion energy applications.* 351p. Order Number DE91716261. Source: NTIS (US Sales Only), PC A16/MF A01.

The importance of sequential (x,n) reactions on element activation in fusion reactors is demonstrated by a few examples studied recently. It is shown that the time-dependent total element activity in some cases is strongly governed by contributions from such reactions at least for light and medium weight elements and cooling times above more than 1 year. The nuclear data needs related to this type of reactions are briefly discussed.

54091 Scaled-factorial-moment analysis of 200*A*-GeV sulfur+gold interactions. Adamovich, M.I.; Aggarwal, M.M.; Alexandrov, Y.A.; Ameeva, Z.V.; Andreeva, N.P.; Anzon, Z.V.; Arora, R.; Badyal, S.K.; Bhalla, K.B.; Bhasin, A.; Bhatia, V.S.; Bubnov, V.I.; Burnett, T.H.; Cai, X.; Chasnikov, I.Y.; Chernova, L.P.; Chernyavski, M.M.; Dressel *Physical Review Letters (USA),* 65(4): 412-415 (23 Jul 1990). DOE Contract AS06-88ER40423.

S+Au interactions at 200*A* GeV were observed using emulsion chambers, permitting measurement of pseudorapidities in the central region with precision ~0.01 unit. Scaled-factorial-moment analyses are extended to bin sizes smaller than those accessible to other fixed-target experimental techniques. For a sample of 151 central collisions, moments are calculated using both "horizontal" and "vertical" analysis techniques. While the moments are found to rise (in a log-log plot) with decreasing pseudorapidity bin size $\delta\eta$, their slopes roll off to approximately zero for $\delta\eta<0.1$.

54092 Electroexcitation of 6^- states in ^{32}S. Clausen, B.L. (Institute of Nuclear and Particle Physics, University of Virginia, Charlottesville, VA (USA)); Lindgren, R.A.; Farkhondeh, M.; Fagg, L.W.; Sober, D.I.; de Jager, C.W.; de Vries, H.; Kalantar-Nayestanaki, N. *Physical Review Letters (USA),* 65(5): 547-550 (30 Jul 1990).

Inelastic electron scattering is used to identify nine stretched isovector $T_>$ ($T_0 \rightarrow T_0+1$) *M*6 transitions in ^{32}S ($T_0=0$) which exhaust (77±17)% of the extreme single-particle-hole-model sum rule. This is the first time that several prominent $T_>$ electromagnetic stretched transitions have been observed in a self-conjugate nucleus and the first time that such a large fraction of the sum rule has been observed. These effects are primarily due to the presence of spectator nucleons in the $2s_{1/2}$ orbit, as substantiated by shell-model calculations.

6515 Nuclear Properties and Reactions, A = 39-58, Experimental

Refer also to citation(s) 54090, 54365

54093 (CEA-N–2628) **Collective flow studies in central collisions between nuclei at several hundreds of MeV per nucleon.** Demoulins, M. CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Physique Nucleaire; Paris-11 Univ., 91 - Orsay (France). Feb 1990. 225p. (In French). Order Number DE91702082. Source: NTIS (US Sales Only), PC A10/MF A01.

The main purpose for studying collisions between heavy nuclei in the 200-2000 MeV/nucleon energy range is to determine the equation of state and the properties of dense and hot nuclear matter. The insensitiveness of the inclusive data to the equation of state has led experimental physicists to build large solid angle detectors capable of detecting simultaneously the tens of particles emitted in each event. Such measurements allow to estimate the impact parameter, the reaction plane on an event-by-event basis, and to calculate various global variables involving all particles emitted in each event. We study global variables which characterize the nuclear matter collective flow in a direction which is different from the direction of incident motion, for argon-nucleus collisions at 400 and 600 MeV/nucleon and for neon-nucleus collisions at 400 and 800 MeV/nucleon. The measurements have been performed with the DIOGENE detector at SATURNE. For the argon-beam experiments, two parallel plate avalanche counters have been used to locate the interaction point of each incoming ion with the target, which improves the reconstruction of the particle tracks in the DIOGENE central chamber. Double differential cross-sections, in the reaction plane and in the plane orthogonal to the reaction plane, are fitted with two-dimensional Gaussian distributions. Through this procedure, we get rid of geometrical acceptance effects. Several quantities, related to the collective flow (flow angle, aspect ratios, flow parameter), are thus extracted and corrected for the fluctuations of the estimated reaction plane. For argon-nucleus collisions at 400 MeV by nucleon, our results are in agreement with results obtained by other groups with different methods. For argon-nucleus collisions, the discrepancy between our experimental results and predictions of intranuclear cascade calculations is increasing with the mass asymmetry of the colliding system.

54094 (CNIC-I–004, pp. 34-35) **The correlation between α particles and projectile-like fragments in 97 MeV ^{16}O + ^{51}V reaction.** Wang Qi (and others); Wang Gaosheng; Zhu Yongtai. China Nuclear Information Centre, Beijing, BJ (China); Academia Sinica, Lanzhou, GS (China). Inst. of Modern Physics. Jun 1990. In *IMP annual report, 1988 (January-December).* 138p. Order Number DE91606195. Source: NTIS (US Sales Only), PC A07/MF A01; OSTI; INIS.

Published in summary form only. ALPHA SPECTRA/correlations; VANADIUM 51 TARGET/oxygen 16 reactions; ALPHA PARTICLES; CORRELATIONS; EXPERIMENTAL DATA; MEV RANGE 10-100; NUCLEAR FRAGMENTS; PARTICLE KINEMATICS; SHADOW EFFECT

54095 (CNIC-I–004, pp. 36) **The measurement and theoretical analysis of inclusive α-particle emission in 97 MeV ^{16}O + ^{51}V reaction.** Wang Gaoshen (and others); Wang Qi; Zhu Yongtai. China Nuclear Information Centre, Beijing, BJ (China); Academia Sinica, Lanzhou, GS (China). Inst. of Modern Physics. Jun 1990. In *IMP annual report, 1988 (January-December).* 138p. Order Number DE91606195. Source: NTIS (US Sales Only), PC A07/MF A01; OSTI; INIS.

Published in summary form only. ALPHA PARTICLES/angular distribution; VANADIUM 51 TARGET/oxygen 16 reactions; COMPARATIVE EVALUATIONS; CROSS SECTIONS; EVAPORATION MODEL; EXCITON MODEL; EXPERIMENTAL DATA; INCLUSIVE INTERACTIONS; MEV RANGE 10-100

54096 (CNIC-I–004, pp. 37) **The break-up of projectiles in 97 MeV ^{16}O + ^{51}V reaction.** Wang Gaosheng; Zhu Yongtai; Wang Xiaoming; Wang Qi; Hu Xiaoqing; Li Songlin. China Nuclear Information Centre, Beijing, BJ (China); Academia Sinica, Lanzhou, GS (China). Inst. of Modern Physics. Jun 1990. In *IMP annual report, 1988 (January-December).* 138p. Order Number DE91606195. Source: NTIS (US Sales Only), PC A07/MF A01; OSTI; INIS.

Published in summary form only. PROJECTILES/breakup reactions; VANADIUM 51 TARGET/oxygen 16 reactions; ALPHA PARTICLES; CORRELATIONS; ENERGY; EXPERIMENTAL DATA; MEV RANGE 10-100; PROJECTILES

54097 (GANIL-P–9002) **Study of very neutron-rich nuclei produced by means of a ^{48}Ca beam.** Lewitowicz (Paris-11 Univ., 91 - Orsay (FR). Inst. de Physique Nucleaire); Guillemaud-Mueller, D.; Jacmart, J.C.; Latimier, A.; Mueller, A.C.; Pougheon, F.; Richard, A.; Artukh, A.G.; Belozyorov, A.V.; Lukyanov, S.M.; Penionzhkevich, Yu.E.; Bazin, D.; KashGrand Accelerateur National d'Ions Lourds (GANIL), 14 - Caen (France). 1990. 10p. (CONF-8911216–: Workshop on the contribution to the Nuclear Structure of Light Nuclei far from Stability Experiment and Theory Workshop, Overnai (France), 27-29 Nov 1989). Order Number DE91716318. Source: NTIS (US Sales Only), PC A02/MF A01.

The results of experiments with a ^{48}Ca beam performed at GANIL are presented and discussed. More than 30 very neutron-rich isotopes were identified or studied for the first time. The evidence for particle-unstable character of the ^{26}O isotope is reported. Half-life measurements for light neutron rich nuclei are compared with different theoretical predictions.

54098 (NEANDC–259-U, pp. 111-119) **Improved neutron fluence accuracies in activation experiments.** Liskien, H. (Commission of the European Communities, Geel, (BE). Central Bureau

for Nuclear Measurements). Nuclear Energy Agency, 75 - Paris (France). 1990. (CONF-890982--: Specialists' meeting on neutron activation cross sections for fission and fusion energy applications, Argonne, IL (USA), 13-15 Sep 1989). In *Proceedings of a specialists' meeting on neutron activation cross sections for fission and fusion energy applications.* 351p. Order Number DE91716261. Source: NTIS (US Sales Only), PC A16/MF A01.

The more recent activation cross section work at CBNM Geel has been performed in cooperation with KFA Julich and IRK Vienna. At present two articles are in print which result from these cooperations. Here I highlight two aspects of improved accurate neutron fluence determinations: (1) The correct averaging of two sets of independent fluence results - obtained by a recoil proton method and by aluminium activation - taking into account the necessarily existing correlations; and (2) a method to determine more accurately the neutron source position by using the activity ratios of symmetrically exposed samples and a-priori information on the neutron source property and the excitation function.

54099 (NEANDC–259-U, pp. 165-176) **Neutron activation cross-sections of ^{58}Ni and ^{60}Ni for 8 - 12 MeV neutrons.** Vonach, H. (Vienna Univ. (AT). Inst. fuer Radiumforschung und Kernphysik); Wagner, M.; Haight, R.C. Nuclear Energy Agency, 75 - Paris (France). 1990. (CONF-890982--: Specialists' meeting on neutron activation cross sections for fission and fusion energy applications, Argonne, IL (USA), 13-15 Sep 1989). In *Proceedings of a specialists' meeting on neutron activation cross sections for fission and fusion energy applications.* 351p. Order Number DE91716261. Source: NTIS (US Sales Only), PC A16/MF A01.

The cross-sections of the reactions ^{58}Ni(n,p) ^{58}Co, and ^{60}Ni(n,p) ^{60}Co were measured for E_n = 8 - 12 MeV using the H(t,n) ^{3}He reaction for neutron production. It is shown that the H(t,n) reaction is very well suited for cross-section measurements in the difficult neutron energy region. 8 - 12 MeV, where most other source reactions are no longer truly monoenergetic. In these first preliminary measurements the uncertainties still amount to 3 - 7%, however from the experience gained in this experiment it can be concluded that an accuracy of 2-3% can be obtained in future experiments. The results for ^{60}Ni(n,p) ^{60}Co deviate considerably from previous measurements and suggest that the nuclear data libraries for this reaction should be revised considerably.

54100 (NEANDC–259-U, pp. 263-273) **Efficiency examinations for reaction parameter estimation by a statistical method and experiments.** Kanda, Y. (Faculty of Engineering, Kyushu Univ. Fukuoka, (JP)); Uenohara, Y.; Kawano, T. Nuclear Energy Agency, 75 - Paris (France). 1990. (CONF-890982--: Specialists' meeting on neutron activation cross sections for fission and fusion energy applications, Argonne, IL (USA), 13-15 Sep 1989). In *Proceedings of a specialists' meeting on neutron activation cross sections for fission and fusion energy applications.* 351p. Order Number DE91716261. Source: NTIS (US Sales Only), PC A16/MF A01.

Nuclear reaction parameters in reaction model formulae have been estimated with Bayes method by using experimental data. A feature of the method is that prior parameters can be assumed taking account of early information. In the present work, prior optical potential parameters are changed and then posterior cross sections calculated from the estimated parameters of the early and the present are compared. They approximately agree in spite of the difference between the two prior cross sections. It shows that the estimation of the parameters does not depend on the initial values. In addition, proton-induced data are used to estimate the parameters together with the early neutron-induced reaction data. It is useful to obtain the parameters required for calculating activation cross sections.

54101 (NEANDC–259-U, pp. 275-283) **A review of activation cross sections in the ENDF/B-VI general purpose files for Cr, Fe, Ni, Cu, and Pb.** Fu, C.Y. (Oak Ridge National Lab. TN (US)). Nuclear Energy Agency, 75 - Paris (France). 1990. (CONF-890982--: Specialists' meeting on neutron activation cross sections for fission and fusion energy applications, Argonne, IL (USA), 13-15 Sep 1989). In *Proceedings of a specialists' meeting on neutron activation cross sections for fission and fusion energy applications.* 351p. Order Number DE91716261. Source: NTIS (US Sales Only), PC A16/MF A01.

Isotopic evaluations for ^{50,52,53,54}Cr, ^{54,56,57,58}Fe, ^{58,60,61,62,64}Ni, ^{63,65}Cu, and ^{206,207,208}Pb are included in ENDF/B-VI for the first time. These general purpose files, all by the ORNL evaluation group, include many activation cross sections. In this review, the 34 activation reactions for these materials in the priority-I CSEWG list were checked for their presence and contents in the general purpose files. These cross sections are reviewed in terms of the experimental data base and the evaluation methods. Most of them have been significantly improved over ENDF/B-V through the improved data base and the use of advanced codes such as SAMMY for resonance analysis, GLUCS for handling ratio data and covariances, and TNG for cross-section shape and for extracting individual cross sections from the measured particle spectrum.

54102 (NEANDC–259-U, pp. 309-328) **Evaluation of cross sections for important neutron dosimetry reactions.** Wagner, M. (Vienna Univ. (AT). Inst. fuer Radiumforschung und Kernphysik); Martinez-Rico, J.; Pavlik, A.; Strohmaier, B.; Tagesen, S.; Vonach, H. Nuclear Energy Agency, 75 - Paris (France). 1990. (CONF-890982--: Specialists' meeting on neutron activation cross sections for fission and fusion energy applications, Argonne, IL (USA), 13-15 Sep 1989). In *Proceedings of a specialists' meeting on neutron activation cross sections for fission and fusion energy applications.* 351p. Order Number DE91716261. Source: NTIS (US Sales Only), PC A16/MF A01.

The evaluation of the cross sections for a number of important neutron dosimetry reactions carried out at the IRK about ten years ago were updated taking into account recent experimental results reported up to June 1989. Besides, new evaluations are performed for four additional dosimetry reactions, namely ^{52}Cr(n,2n) ^{51}Cr, ^{59}Co(n,2n) ^{58}Co, ^{93}Nb(n,2n) ^{92m}Nb and ^{197}Au(n,2n) ^{196}Au. The evaluations comprise the neutron energy range from threshold to 20 MeV, in a few cases this range is extended up to 21 MeV or 30 MeV. Cross sections were evaluated in energy groups with widths of 0.1 MeV to 2.0 MeV and relative correlation matrices were derived describing the uncertainties of the evaluated cross sections at different energies. The results of the updated evaluations are compared to the previous ones and in the case of the reaction ^{27}Al(n,α) ^{24}Na also to an evaluation reported by Kornilov.

6516 Nuclear Properties and Reactions, A = 59-89, Experimental

Refer also to citation(s) 54086, 54099, 54100, 54101, 54102, 54363

54103 (BNL–45238) **Progress and open problems in hypernuclear structure.** Millener, D.J. Brookhaven National Lab., Upton, NY (USA). Aug 1990. 7p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. (CONF-900601–14: 12. PANIC international conference on particles and nuclei, Cambridge, MA (USA), 24-29 Jun 1990). Order Number DE91001114. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

Λ hypernuclei exist as particle–stable systems with spectroscopies analogous to those of ordinary nuclei. The analysis of Brookhaven data on (π^+, K^+) reactions, for selected targets up to A $\sim$ 90, has yielded information on Λ single-particle energies and thus the Λ-nucleus mean field. Better energy resolution and higher intensity beams are needed to carry out coincidence experiments and detailed spectroscopic studies. The prospects for investigating hypernuclear structure at high-energy electron accelerator facilities via the (e,e' K or γ,K) reactions, which are kinematically similar to the (π^+, K^+) reaction, but which favor spin-flip transitions, are also considered. 13 refs.

54104 (CNIC-I–004, pp. 24-25) **Optical model analysis of elastic scattering angular distribution for the ^{12}C + ^{64}Ni reaction.** Liu Guoxing; Yu Xian; Zheng Jiwen; Bai Xingping; Chen Keliang; Wang Sufang; Fan Zhiguo. China Nuclear Information Centre, Beijing, BJ (China); Academia Sinica, Lanzhou, GS (China). Inst. of Modern Physics. Jun 1990. In *IMP annual report, 1988 (January-December).* 138p. Order Number DE91606195. Source: NTIS (US Sales Only), PC A07/MF A01; OSTI; INIS.

Published in summary form only. ELASTIC SCATTERING/ angular distribution; NICKEL 64 TARGET/carbon 12 reactions;

COULOMB FIELD; DIFFERENTIAL CROSS SECTIONS; EXPERIMENTAL DATA; MEV RANGE 10-100; OPTICAL MODELS; WOODS-SAXON POTENTIAL

54105 (CNIC-I–004, pp. 31-32) **Analysis of optimum Q_{eff}^{m} values in $^{12}C + ^{64}Ni$ transfer reaction.** Fan Zhiguo; Zheng Jiwen; Liang Guozhao; Bai Xinping; Liu Guoxing; Chen Keliang; Wang Sufang; Yu Xian. China Nuclear Information Centre, Beijing, BJ (China); Academia Sinica, Lanzhou, GS (China). Inst. of Modern Physics. Jun 1990. In *IMP annual report, 1988 (January-December).* 138p. Order Number DE91606195. Source: NTIS (US Sales Only), PC A07/MF A01; OSTI; INIS.

Published in summary form only. NICKEL 64 TARGET/carbon 12 reactions; Q-VALUE/transfer reactions; EXPERIMENTAL DATA; HEAVY IONS; NUCLEAR REACTION KINETICS; Q-VALUE

54106 (CNIC-I–004, pp. 48-49) **Radiochemical study on complete fusion in reaction of ^{16}O on ^{65}Cu.** Li Wenxin; Sun Rulin; Wu Dingqing; Li Yunsheng; Sun Tongyu; Zhao Zhizheng; Jin Genming. China Nuclear Information Centre, Beijing, BJ (China); Academia Sinica, Lanzhou, GS (China). Inst. of Modern Physics. Jun 1990. In *IMP annual report, 1988 (January-December).* 138p. Order Number DE91606195. Source: NTIS (US Sales Only), PC A07/MF A01; OSTI; INIS.

Published in summary form only. COPPER 65 TARGET/heavy ion fusion reactions; HEAVY ION FUSION REACTIONS/nuclear reaction analysis; OXYGEN 16/heavy ion fusion reactions; ANGULAR DISTRIBUTION; ATOMIC NUMBER; CROSS SECTIONS; EXCITATION FUNCTIONS; MEV RANGE 10-100; RECOILS; SPECTRA

54107 (KURRI-TR–333, pp. 16-20) **Laser spectroscopy of nuclei in rare earth elements (Z=60-68).** Wakasugi, Masanori (Hiroshima Univ. (Japan). Faculty of Science); Horiguchi, Takayoshi; Jin, W.G.; Yoshizawa, Yasukazu. Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst. Apr 1990. (In Japanese). (CONF-9001108–: 2. specialist research meeting on studies of nuclear chemistry and nuclear physics at research reactor, Kumatori (Japan), 17-18 Jan 1990). In *Proceedings of the 2nd specialist research meeting on studies of nuclear chemistry and nuclear physics at research reactor.* 101p. Order Number DE90513872. Source: NTIS (US Sales Only), PC A06/MF A01.

Published in summary form only. LASER SPECTROSCOPY/hyperfine structure; LASER SPECTROSCOPY/spectral shift; GADOLINIUM 155/quadrupole moments; GADOLINIUM 157/quadrupole moments; NUCLEAR ELECTRIC MOMENTS

54108 (NEANDC–259-U, pp. 229-240) **Calculation of isomeric states production with a simplified-input nuclear cross section calculation system.** Yamamuro, N. Nuclear Energy Agency, 75 - Paris (France). 1990. (CONF-890982–: Specialists' meeting on neutron activation cross sections for fission and fusion energy applications, Argonne, IL (USA), 13-15 Sep 1989). In *Proceedings of a specialists' meeting on neutron activation cross sections for fission and fusion energy applications.* 351p. Order Number DE91716261. Source: NTIS (US Sales Only), PC A16/MF A01.

Isomeric states production cross sections are given by A Simplified-Input Nuclear Cross Section Calculation System, version-II (SINCROS-II). The cross section calculations were performed with the ELIESE-GNASH joint program, and the results of these are able to convert to the activation cross section file 10 of ENDF/B format. The calculated isomer cross sections resulted in a good agreement with the experimental data. The availability of the SINCROS-II for the prediction of cross sections, which were not measured, will be demonstrated.

6517 Nuclear Properties and Reactions, A = 90-149, Experimental

Refer also to citation(s) 54093, 54098, 54102, 54103, 54108, 54365

54109 (CEA-CONF–10209) **Correlations between projectile-like and target-like fragments in the reaction $^{40}Ar+^{nat}Ag$ at 60 MeV/nucleon.** Charvet, J.L. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Physique Nucleaire); Gadi, F.; Barrette, J.; Dayras, R.; Faure, B.; Legrain, R.; Pollacco, E.C.; Wieleczko, J.P.; Lanzano, G.; Pagano, A.; Delagrange, H.; HeuscCEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Physique Nucleaire. 1990. 10p. (CONF-9001120–: 18. International Winter Meeting on Nuclear Physics, Bormio (Italy), 22-26 Jan 1990). Order Number DE91716202. Source: NTIS (US Sales Only), PC A02/MF A01.

Velocity, mass and angular correlations between projectile-like and target-like fragments have been measured in the $^{40}Ar+Ag$ reaction at 60 MeV/u. With respect to similar data taken at 30 MeV/u, important deviation are observed in the mass correlation. A calculation assuming a binary process in which, before decaying, the projectile and the target are excited by stochastic exchange of nucleons seems to give a better agreement with the data than predictions based on the partipant-spectator model.

54110 (CNIC-I–004, pp. 39-40) **New excited states of the nucleus ^{129}Xe.** Zhao Zhizhen (Academia Sinica, Lanzhou, GS (China). Inst. of Modern Physics); Yan Jiangang; Gelberg, A.; Reinhardt, R.; Lieberz, W.; Dewald, A.; Wirowski, R.; Zell, K.O.; Brentano, P. von. China Nuclear Information Centre, Beijing, BJ (China); Academia Sinica, Lanzhou, GS (China). Inst. of Modern Physics. Jun 1990. In *IMP annual report, 1988 (January-December).* 138p. Order Number DE91606195. Source: NTIS (US Sales Only), PC A07/MF A01; OSTI; INIS.

Published in summary form only. TELLURIUM 126 TARGET/alpha reactions; XENON 129/energy levels; EXPERIMENTAL DATA; LEVEL WIDTHS; MEV RANGE 10-100; TANDEM ELECTROSTATIC ACCELERATORS

54111 (CNIC-I–004, pp. 41) **In-beam γ-ray measurement of ^{124}Ba.** Guo Yingxiang (and others); Sun Xiangfu; Luo Yixiao. China Nuclear Information Centre, Beijing, BJ (China); Academia Sinica, Lanzhou, GS (China). Inst. of Modern Physics. Jun 1990. In *IMP annual report, 1988 (January-December).* 138p. Order Number DE91606195. Source: NTIS (US Sales Only), PC A07/MF A01; OSTI; INIS.

Published in summary form only. BARIUM 124/in-beam spectroscopy; SILVER 109 TARGET/fluorine 19 reactions; EXCITED STATES; EXPERIMENTAL DATA; GAMMA RADIATION; TANDEM ELECTROSTATIC ACCELERATORS

54112 (CNIC-I–004, pp. 44) **Mechanism of the IMF in $^{84}Kr + ^{197}Au$ at 44 MeV/u.** Jin Genming. China Nuclear Information Centre, Beijing, BJ (China); Academia Sinica, Lanzhou, GS (China). Inst. of Modern Physics. Jun 1990. In *IMP annual report, 1988 (January-December).* 138p. Order Number DE91606195. Source: NTIS (US Sales Only), PC A07/MF A01; OSTI; INIS.

Published in summary form only. GOLD 197 TARGET/krypton 84 reactions; NUCLEAR REACTION KINETICS/intermediate mass nuclei; GANIL CYCLOTRON; MASS DISTRIBUTION; NUCLEAR FRAGMENTS

54113 (CNIC-I–004, pp. 47) **Observation of incomplete fusion in $^{16}O + ^{115}In$ at 93 and 72 MeV.** Li Weixin; Sun Tongyu; Jin Genming; Zhao Lili; Wu Dingqing. China Nuclear Information Centre, Beijing, BJ (China); Academia Sinica, Lanzhou, GS (China). Inst. of Modern Physics. Jun 1990. In *IMP annual report, 1988 (January-December).* 138p. Order Number DE91606195. Source: NTIS (US Sales Only), PC A07/MF A01; OSTI; INIS.

Published in summary form only. INDIUM 115 TARGET/incomplete fusion reactions; NUCLEAR REACTION YIELD/nuclear reaction analysis; OXYGEN 16/incomplete fusion reactions; ANGULAR DISTRIBUTION; ATOMIC NUMBER; CROSS SECTIONS; GAMMA SPECTROSCOPY; MEV RANGE 10-100; MOMENTUM TRANSFER; RECOILS

54114 (CNIC-I–004, pp. 55-56) **Excitation functions for ^{16}O-induced reaction on ^{115}In.** Sun Tongyu; Li Wenxin; Wu Dingqing; Wang Sufang; Xu Shuwei; Zhao Lili; Guo Yingxiang; Sun Xiurong. China Nuclear Information Centre, Beijing, BJ (China); Academia Sinica, Lanzhou, GS (China). Inst. of Modern Physics. Jun 1990. In *IMP annual report, 1988 (January-December).* 138p. Order Number DE91606195. Source: NTIS (US Sales Only), PC A07/MF A01; OSTI; INIS.

Published in summary form only. INDIUM 115 TARGET/oxygen 16 reactions; OXYGEN 16 REACTIONS/nuclear reaction analysis;

CROSS SECTIONS; EXCITATION FUNCTIONS; GAMMA SPECTROSCOPY; MEV RANGE 10-100

54115 (KURRI-TR–333, pp. 21-25) **Measurement of release speeds of La and Ce from a thermal ion source.** Ichikawa, Shinichi (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment); Sekine, Toshiaki; Iimura, Hideki; Oshima, Masumi. Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst. Apr 1990. (In Japanese). (CONF-9001108–: 2. specialist research meeting on studies of nuclear chemistry and nuclear physics at research reactor, Kumatori (Japan), 17-18 Jan 1990). In *Proceedings of the 2nd specialist research meeting on studies of nuclear chemistry and nuclear physics at research reactor.* 101p. Order Number DE90513872. Source: NTIS (US Sales Only), PC A06/MF A01.

Published in summary form only. ION SOURCES/cerium ions; ION SOURCES/lanthanum ions; SURFACE IONIZATION; HALF-LIFE; MOLECULAR IONS

54116 (NEANDC–259-U, pp. 135-142) **Neutron activation cross-section measurements on zirconium, niobium and molybdenum in the energy range of 4 to 10 MeV using radiochemical techniques.** Qaim, S.M. (Inst. fuer Chemie Kernforschungsanlage Juelich G.m.b.H. (DE)). Nuclear Energy Agency, 75 - Paris (France). 1990. (CONF-890982–: Specialists' meeting on neutron activation cross sections for fission and fusion energy applications, Argonne, IL (USA), 13-15 Sep 1989). In *Proceedings of a specialists' meeting on neutron activation cross sections for fission and fusion energy applications.* 351p. Order Number DE91716261. Source: NTIS (US Sales Only), PC A16/MF A01.

A brief review of our recent neutron activation cross-section measurements on Zr, Nb and Mo is given. The quasi-monoenergetic neutrons in the energy range of 4 to 10 MeV were obtained using a D_2 gas target at a variable energy compact cyclotron CV 28. The neutron flux densities were determined using standard monitor reactions. For measurement of radio-activity mainly conventional γ-ray spectroscopy was used. In several cases, however, radiochemical separations were mandatory; use was made of low-level anticoincidence β^- counting or X-ray spectroscopy. Several of the reported excitation functions constitute first systematic studies near reaction thresholds.

54117 (NEANDC–259-U, pp. 177-188) **Neutron capture cross section measurements in the energy region 2.0-7.7 MeV using activation technique.** Zorro, R. (Lund, Univ. (SE). Dept. of Physics). Nuclear Energy Agency, 75 - Paris (France). 1990. (CONF-890982–: Specialists' meeting on neutron activation cross sections for fission and fusion energy applications, Argonne, IL (USA), 13-15 Sep 1989). In *Proceedings of a specialists' meeting on neutron activation cross sections for fission and fusion energy applications.* 351p. Order Number DE91716261. Source: NTIS (US Sales Only), PC A16/MF A01.

A summary will be given of work performed at Lund to investigate sources of systematic errors in (n,γ) activation cross section measurements. The experimental setup, the correction methods and the results for the $^{115}In(n,\gamma)^{116m}In$ and $^{197}Au(n,\gamma)^{198}Au$ reactions in the energy region 2.0-7.7 MeV will be presented.

54118 (NEANDC–259-U, pp. 201-216) **Testing new approaches to calculate radiative capture cross-sections.** Kopecky, J. (Netherlands Energy Research Foundation, Petten (NL)); Delfini, M.G.; Gruppelaar, H.; Uhl, M. Nuclear Energy Agency, 75 - Paris (France). 1990. (CONF-890982–: Specialists' meeting on neutron activation cross sections for fission and fusion energy applications, Argonne, IL (USA), 13-15 Sep 1989). In *Proceedings of a specialists' meeting on neutron activation cross sections for fission and fusion energy applications.* 351p. Order Number DE91716261. Source: NTIS (US Sales Only), PC A16/MF A01.

The impact of using global parameters on the calculation of the capture cross-section has been studied. A simplified statistical model MASGAM, with 1/v and direct-semidirect components has been developed at ECN. The input is prepared from minimum information such as Z, A and level scheme information, using global systematics of relevant parameters. Some preliminary results are shown and compared with more sophisticated calculations. Further, the influence of different models for E1- and M1 γ-ray strength functions on the results of model calculations of the total radiative width, capture cross-sections and γ-ray spectra was studied with the IRK code MAURINA. The results suggest that the predictability of radiative capture cross-section models for unstable targets could be increased.

6518 Nuclear Properties and Reactions, A = 150-189, Experimental

54119 (NEANDC–259-U, pp. 143-152) **Ho, Pb and Bi cross sections for 14.3 MeV neutrons.** Ryves, T.B. (National Physical Lab. Teddington (UK)); Kolkowski, P.; Hooley, A.C. Nuclear Energy Agency, 75 - Paris (France). 1990. (CONF-890982–: Specialists' meeting on neutron activation cross sections for fission and fusion energy applications, Argonne, IL (USA), 13-15 Sep 1989). In *Proceedings of a specialists' meeting on neutron activation cross sections for fission and fusion energy applications.* 351p. Order Number DE91716261. Source: NTIS (US Sales Only), PC A16/MF A01.

The $^{165}Ho(n,p)$, $^{165}Ho(n,\alpha)$, $^{204}Pb(n,n')$,$^{204}Pb(n,2n)$, $^{208}Pb(n,p)$, $^{209}Bi(n,p)$ and $^{209}Bi(n,\alpha)$ activation cross sections were measured at 14.3 MeV. Most of the uncertainties were much smaller than in previously published work, and should help to resolve some of the discrepancies noted by Forrest in his work on the systematics of neutron-induced threshold reactions.

54120 (NEANDC–259-U, pp. 241-251) **Calculation of the production cross sections of high-spin isomeric states in hafnium.** Chadwick, M.B. (Oxford, Univ. (UK). Nuclear Physics Lab.); Young, P.G. Nuclear Energy Agency, 75 - Paris (France). 1990. (CONF-890982–: Specialists' meeting on neutron activation cross sections for fission and fusion energy applications, Argonne, IL (USA), 13-15 Sep 1989). In *Proceedings of a specialists' meeting on neutron activation cross sections for fission and fusion energy applications.* 351p. Order Number DE91716261. Source: NTIS (US Sales Only), PC A16/MF A01.

The $J^\pi = 16^+$ isomeric state in ^{178}Hf (E_x = 2.447 MeV), which has a halflife of 31 years, poses a threat for serious radioactive activation problems in some fusion reactor designs if its production in 14-MeV neutron reactions is significant. The relatively high excitation energy of this state results in it lying in the continuum region, so it is necessary in a calculation to reconstruct the salient nuclear structure around the state, particularly rotational band levels that might be populated and would feed into it. Using preequilibrium and Hauser-Feshbach statistical theories, the cross sections for this and other hafnium isomeric states are calculated and compared with experimental measurements, where available.

6519 Nuclear Properties and Reactions, A = 190-219, Experimental

Refer also to citation(s) 54085, 54091, 54093, 54101, 54102, 54117, 54118, 54119

54121 (BNL–45239) **Bose-Einstein correlations in 14.6 A·GeV/c ^{28}Si + A collisions.** Morse, R.J. (Massachusetts Inst. of Tech., Cambridge, MA (USA)). E802 Collaboration. Brookhaven National Lab., Upton, NY (USA). [1990]. 5p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. (CONF-900570–13: 8. international conference on ultrarelativistic nucleus-nucleus collisions: Quark Matter '90, Menton (France), 7-11 May 1990). Order Number DE91001116. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

The E802 spectrometer at the Brookhaven AGS has been used to obtain two-particle inclusive pion distributions from E/A = 14.6 GeV ^{28}Si + ^{197}Au and ^{27}Al interactions. Data are presented for pions near center-of-mass rapidity, in the nucleon-nucleon frame, from central events. We present preliminary results for source distribution parameters obtained by fitting the two-particle correlation function. The potential for studying kaon correlations in the E802 apparatus is also discussed.

54122 (DOE/ER/40402–3) **Oregon State University nuclear chemistry progress report, August 1, 1989–August 1, 1990.**

Loveland, W.D. Oregon State Univ., Corvallis, OR (USA). Aug 1990. 35p. Sponsored by U.S. DOE Energy Research. DOE Contract FG06-88ER40402. Order Number DE91001142. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

This report discusses the following topics: the elements beyond uranium; the interaction of 21 MeV/nucleon ^{129}Xe with ^{197}Au; the interaction of 93 MeV/nucleon ^{36}Ar with ^{197}Au, participant-spectator physics; consistency test of two measures of linear momentum transfer; the interaction of ~30 MeV/nucleon projectiles with ^{197}Au; gold target fragmentation by 800 GeV protons; target fragment mass distribution for the reaction of 13.3 GeV/nucleon ^{28}Si with ^{197}Au; momentum distributions of spallation products from the interaction of 400 MeV/nucleon ^{12}C with ^{197}Au; and pulse height defects for very low energy, very heavy ions.

54123 (UCRL-JC-106177) **Very elongated nuclei near A = 194.** Becker, J.A. (Lawrence Livermore National Lab., CA (USA)); Henry, E.A.; Yates, S.W.; Wang, T.F.; Kuhnert, A.; Brinkman, M.J.; Cizewski, J.A.; Deleplanque, M.A.; Diamond, R.M.; Stephens, F.S.; Azaiez, F.; Korten, W.; Draper, J.E. Lawrence Livermore National Lab., CA (USA). Oct 1990. 12p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-901116--12: 11. international conference on the application of accelerators in research and industry, Denton, TX (USA), 5-8 Nov 1990). Order Number DE91000971. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A γ-ray cascade in ^{191}Hg of 12 members with average energy spacing 37 keV and Q_t = 18(3)eb was reported by Moore, and coworkers in 1989. This was the first report of very elongated nuclei (superdeformation) in this mass region. Since then, some 25 γ-ray cascades have been observed in 11 (slightly neutron deficient) Hg, Pb and Tl nuclei. The bands have similar dynamic moments-of-inertia. Some nuclei exhibit multiple bands, and the backbending phenomena has been observed. Level spins can be obtained from comparison of transition energies to rotational model formulas. Selected bands (in different nuclei) have equal transition energies (within 0.1%). Alignment in integer multiples of $\hbar$ has been observed. Properties of these bands will be described. 27 refs., 3 figs.

54124 Onset of flow of charged fragments in Au-Au collisions. Zhang, W.M. (Kent State University, Kent, Ohio 44242 (USA)); Madey, R.; Elaasar, M.; Schambach, J.; Keane, D.; Anderson, B.D.; Baldwin, A.R.; Cogar, J.; Watson, J.W.; Westfall, G.D.; Krebs, G.; Wieman, H. *Physical Review, C (Nuclear Physics) (USA)*, 42(2): R491-R494 (Aug 1990). DOE Contract FG02-89ER40531 ;AC03-76SF00098.

The reaction plane of high-multiplicity Au-Au collisions at 650, 400, 250, 150, and 75 MeV/nucleon was determined by measuring the transverse velocity of charged fragments. Measurements of the collective flow of charged fragments reveal that the onset of flow in high-multiplicity Au-Au collisions occurs at a finite beam energy below 60 MeV/nucleon.

6520 Nuclear Properties and Reactions, A = 220 and Above, Experimental

Refer also to citation(s) 54163

54125 (CNIC-I-004, pp. 23-24) **Measurements of half-life time for α-decay and spontaneous fission in Cf source.** Chen Keliang; Liu Guoxing; Wang Sufang; Zheng Jiwen. China Nuclear Information Centre, Beijing, BJ (China); Academia Sinica, Lanzhou, GS (China). Inst. of Modern Physics. Jun 1990. In *IMP annual report, 1988 (January-December)*. 138p. Order Number DE91606195. Source: NTIS (US Sales Only), PC A07/MF A01; OSTI; INIS.

Published in summary form only. CALIFORNIUM 252/alpha decay; CALIFORNIUM 252/spontaneous fission; EXPERIMENTAL DATA; HALF-LIFE; LEAST SQUARE FIT; SURFACE BARRIER DETECTORS; WEIGHTING FUNCTIONS

54126 (CNIC-I-004, pp. 53-54) **Mass distribution in the 14.7 MeV neutron-induced fission of ^{237}Np.** Sun Tongyu; Li Wenxin; Fu Min; Zhao Lili. China Nuclear Information Centre, Beijing, BJ (China); Academia Sinica, Lanzhou, GS (China). Inst. of Modern Physics. Jun 1990. In *IMP annual report, 1988 (January-December)*. 138p. Order Number DE91606195. Source: NTIS (US Sales Only), PC A07/MF A01; OSTI; INIS.

Published in summary form only. FAST FISSION/fission yield; NEPTUNIUM 237/fast fission; FAST NEUTRONS; FISSION PRODUCTS; GAMMA SPECTROSCOPY; MASS DISTRIBUTION; MEV RANGE 10-100; NUCLEAR REACTION ANALYSIS

54127 (NEANDC-259-U, pp. 153-163) **Intercomparison of U-238 deposits employed for neutron fluence determination in neutron activation cross section measurements.** Meadows, J.W. (Argonne National Lab. IL (US)); Smith, D.L.; Winkler, G.; Vonach, H.; Wagner, M. Nuclear Energy Agency, 75 - Paris (France). 1990. Contract W-31-109-Eng-38. (CONF-890982--: Specialists' meeting on neutron activation cross sections for fission and fusion energy applications, Argonne, IL (USA), 13-15 Sep 1989). In *Proceedings of a specialists' meeting on neutron activation cross sections for fission and fusion energy applications*. 351p. Order Number DE91716261. Source: NTIS (US Sales Only), PC A16/MF A01.

An intercomparison is made between a collection of five uranium deposits used for neutron fluence determination in neutron activation experiments at Argonne National Laboratory (ANL), Illinois, U.S.A., and a single corresponding deposit from the Institut fuer Radiumforschung und Kernphysik (IRK), Vienna, Austria. The predominant uranium isotope in each of these deposits is U-238. Two methods were used in the study: low-solid-angle alpha counting and the measurement of fast-neutron fission yield ratios. This investigation produced the following calibration values for the IRK deposit: (160.6±1.7) micrograms from alpha counting and (163.3±2.0) micrograms from fission ratio measurements. The latter value is a weighted average of twenty-four separate measurements.

54128 (NEANDC-259-U, pp. 217-228) **Some neutron and photon reactions on the ground and isomeric states of ^{236,237}Np.** Gardner, D.G. (Lawrence Livermore National Lab. CA (US)); Gardner, M.A. Nuclear Energy Agency, 75 - Paris (France). 1990. (CONF-890982--: Specialists' meeting on neutron activation cross sections for fission and fusion energy applications, Argonne, IL (USA), 13-15 Sep 1989). In *Proceedings of a specialists' meeting on neutron activation cross sections for fission and fusion energy applications*. 351p. Order Number DE91716261. Source: NTIS (US Sales Only), PC A16/MF A01.

We present results of calculated neutron- and photon-induced reactions on the 1.1 x 10^5-y ground state and 22.5-h isomer of ^{236}Np and on the 2.1 x 10^6-y ground state and 68-ns isomer of ^{237}Np. Of primary concern are the isomeric ratios produced although some photon absorption and photoneutron results are given. We discuss the production of the short-lived isomer of ^{236}Np, via the (n,2n) and (γ,n) reactions on ^{237}Np, leading eventually to the high-energy γ-ray emitter, ^{206}Pb; the photoproduction and destruction of the 60-keV, 68-ns isomer of ^{237}Np, a possible gamma-ray laser candidate; and the use of photoexcitation and destruction of nuclear isomers in the field of nuclear waste disposal. The effect of the choice of the physics parameters on the calculated results is also illustrated.

6530 Nuclear Theory

Refer also to citation(s) 53456, 53554, 54075, 54085, 54103

54129 (BNL-45144) **Gamma-ray transitions in $\Lambda\Lambda$ hypernuclei.** May, M. Brookhaven National Lab., Upton, NY (USA). [1990]. 3p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. (CONF-900777-2: Workshop on science at the KAON factory, Vancouver (Canada), 23-28 Jul 1990). Order Number DE91001125. Source: NTIS, PC A01/MF A01; OSTI; INIS; GPO Dep.

Hypernuclei containing two lambda particles are important because of the unique information they hold concerning the $\Lambda\Lambda$ interaction and because of their relationship to proposals for new particles and new states of matter containing multiple strangeness. They are the non-exotic form of strange matter. Intense K^- beams with momentum near 1.8 Gev/c will make it possible to study $\Lambda\Lambda$ hypernuclei. The (K^-,K^+) reaction can be used to form double hypernuclei directly, or through Ξ^- hyperons which are subsequently

slowed down and captured ($\Xi^-p \rightarrow \Lambda\Lambda$). This paper will discuss characteristics γ-ray transitions which may be used as a signature for the existence of double hypernuclei. 5 refs.

54130 (CBPF-NF–005/90) **Firetube model and proton-nucleus collision.** Nazareth, R.A.M.S. (Rio de Janeiro Univ., RJ (Brazil). Inst. de Fisica); Donangelo, R.; Kodama, T.; Duarte, S.B. Centro Brasileiro de Pesquisas Fisicas (CBPF), Rio de Janeiro, RJ (Brazil). 1990. 22p. Order Number DE91605434. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

The firetube model of hadron-hadron collision process is extended to describe proton-nucleus collisions at ultrarelativistic energies. It is calculated the rapidity distributions for α - p for $\sqrt{S}nn$ = 44 GeV and for p-Ar and p-Xe at 200 GeV incident energy. The results are in good agreement to the experimental data. (author).

54131 (CEA-CONF–10050) **Introduction to Nambu Jona-Lasinio models. Applied to low energy hadronic matter.** Ripka, G. CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Service de Physique Theorique. 1989. 34p. (CONF-8908196–: Conference on hadrons and hadronic matter, Cargese (France), 7-18 Aug 1989). Order Number DE91716376. Source: NTIS (US Sales Only), PC A03/MF A01.

We view the Nambu Jona-Lasinio theory to be part of an effective theory for the low energy (possibly 1-2 GeV) properties of hadronic matter. The ideal effective theory we are aiming at should account for the chiral symmetry breaking of the vacuum, its restoration at finite density and temperature, the structure, decays and electro-weak properties of low energy mesons the structure and low energy properties of baryons together with their couplings to the mesons, the modification of hadrons propagating in normal and dense nuclear matter and it should form the basis for a calculation of the equation of state of dense matter.

54132 (CEA-CONF–10051) **Nambu Jona-Lasinio models applied to dense hadronic matter.** Ripka, G. CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Service de Physique Theorique. 1989. 17p. (CONF-8908129–: 12. workshop on nuclear physics, Iguazu Falls (Argentina), 28 Aug - 1 sep 1989). Order Number DE91716375. Source: NTIS (US Sales Only), PC A03/MF A01.

The Nambu Jona-Lasinio model is briefly introduced and applied to dense baryonic matter. The effects of the regularization on the model parameters are discussed. Dense nuclear matter is discussed in the cases where either quarks or nucleons fill the Fermi sea. In the latter case the theory is compared to Walecka's relativistic mean field theory of nuclear matter.

54133 (CEA-CONF–10094) **Time independent mean field for collisions.** Giraud, B.G. CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Service de Physique Theorique. 1990. 6p. (CONF-9001122–: Nuclear Physics Winter School, Hirschegg (Austria), 15-20 Jan 1990). Order Number DE91716373. Source: NTIS (US Sales Only), PC A02/MF A01.

In this lecture, we will use three kinds of shell models, namely (i) the traditionnal (static) shell model, which may be either spherical or deformed, (ii) the boosted shell model, which differs from the latter by just boost operations, and (iii) a completely new shell model, which accounts for intermediate states during transitions.

54134 (CNIC–00247) **Study of the collective motion of nuclei by Monte Carlo methods.** Wang Zhongqi (Academia Sinica, Beijing, BJ (China). Inst. of Atomic Energy). China Nuclear Information Centre, Beijing, BJ (China). 1988. 9p. (In Chinese). (IAE–0059). Order Number DE91605395. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

In this paper, Monte Carlo method has been used to solve the problem of particle transport in a medium with vibrating boundary. By tracing the motion of particle in a vibrating container, the energy exchange between the collective motion and the internal motion of single particle is studied and the influence of Pauli principle is investigated as well. It is turned out that the Pauli principle plays an important role in energy exchange. The amount of energy exchange is effected by the frequency of nuclei vibration, especially by the amplitude of ones. The random effect is dominant as the amplitude is small. The energy exchange will strengthen gradually with the increasing of amplitude and the energy exchange seems to be synchronism with the vibration of nucleus.

54135 (CNIC–00293) **Transformation between pre-and post-neutron-emission fragment mass distributions.** Wang Fucheng (Beijing Univ., BJ (China). Dept. of Technical Physics); Hu Jimin. China Nuclear Information Centre, Beijing, BJ (China). Feb 1989. 16p. (PU–0002). Order Number DE91605474. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

A seven-point interpolation formula is given for the calculation of neutron yields as a function of fragment mass for various fissioning systems. The formula well reproduces the general trends of experimental data for a wide range of fissioning nuclides from Ac to Cf with excitation energies from spontaneous fission to 45 MeV alpha particles induced fission. That permits one to transform the yields between pre-neutron-emission (initial) and post-neutron-emission (final). The transformed yields are well in accord with experiments except fine structures in the fission of actinides. Injunction with the semiempirical formula on the initial fragment mass distributions given in an earlier publication[1], the final yields may be obtained without any help of empirical data. The precision of the prediction is estimated to be $\pm$ 0.5 in the percentage of the yields.

54136 (CNIC–00295) **Study of the level density parameters for back-shifted fermi gas model.** He Ping (Guangxi Univ., Nanning (China). Dept. of Physics); Huang Zhongfu; Su Zhongdi; Zhou Chunmei. China Nuclear Information Centre, Beijing, BJ (China). Jan 1989. 12p. (In Chinese). (GU–0001). Order Number DE91605396. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

The level desity parameters α and delta values of Back-Shifted Fermi Gas Model (B-S model) are updated by applying 652 sets of new experimental data. The expression of the spin cut-off factor and its selected value are improved. The self-consistance test has been performed for the obtained parameters. The parameters can be applied to practical calculation. Meanwhile, the systematics of B-S model level density parameters is preliminarily discussed.

54137 (CNIC–00335) **On the exchange part of nuclear coulomb energy.** Zeng Qiyong (Beijing Univ., BJ (China). Dept. of Technical Physics); Hu Jimin. China Nuclear Information Centre, Beijing, BJ (China). Jul 1989. 11p. (PU–0004). Order Number DE91605397. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

Nuclear Coulomb energies have been studied with different models. It is found that the exchange part of Coulomb energy can be expressed in the usually used formulae with different coefficients. It is estimated that the accuracy of the expressions is better than 1%.

54138 (CNIC-I–004, pp. 10) **An investigation of effective moment of inertia in heavy ion reactions.** Wang Zhengda. China Nuclear Information Centre, Beijing, BJ (China); Academia Sinica, Lanzhou, GS (China). Inst. of Modern Physics. Jun 1990. In *IMP annual report, 1988 (January-December).* 138p. Order Number DE91606195. Source: NTIS (US Sales Only), PC A07/MF A01; OSTI; INIS.

Published in summary form only. MOMENT OF INERTIA/heavy ion reactions; ANGULAR MOMENTUM; CROSSED FIELDS; NUCLEAR CORES; NUCLEI; NUCLEONS; ROTATION; YRAST STATES

54139 (CNIC-I–004, pp. 7) **Nuclear matter radii of extremely neutron-rich nuclei.** Gu Jinnan; Xu Shuwei; Wen Wanxin; Li Junqing; Gao Yuanyi. China Nuclear Information Centre, Beijing, BJ (China); Academia Sinica, Lanzhou, GS (China). Inst. of Modern Physics. Jun 1990. In *IMP annual report, 1988 (January-December).* 138p. Order Number DE91606195. Source: NTIS (US Sales Only), PC A07/MF A01; OSTI; INIS.

Published in summary form only. NUCLEAR RADII/neutron-rich isotopes; BERYLLIUM 14; BORON 17; DINEUTRONS; LITHIUM 11; NUCLEAR MATTER; NUCLEAR MODELS; NUCLEAR THEORY; WOODS-SAXON POTENTIAL

54140 (CNIC-I–004, pp. 8) **The effects of compression and thermal excitation for fragmentation dynamic process.** Ge Lingxiao; Zeng Xianghua; Liu Jianye; Zeng Baoshen. China Nuclear Information Centre, Beijing, BJ (China); Academia Sinica,

Lanzhou, GS (China). Inst. of Modern Physics. Jun 1990. In *IMP annual report, 1988 (January-December)*. 138p. Order Number DE91606195. Source: NTIS (US Sales Only), PC A07/MF A01; OSTI; INIS.

Published in summary form only. NUCLEAR FRAGMENTATION/ion collisions; NUCLEAR MATTER/compression; BOLTZMANN-VLASOV EQUATION; DISTRIBUTION; EXCITATION; HEAVY IONS; HIGH TEMPERATURE; COMPRESSION; NUCLEAR REACTION KINETICS; THREE-DIMENSIONAL CALCULATIONS

54141 (CNIC-I–004, pp. 10-11) **Prequilibrium and incomplete fusion in heavy ion collisions.** Zhang Fengshou; Ge Lingxiao; Wu Guohua. China Nuclear Information Centre, Beijing, BJ (China); Academia Sinica, Lanzhou, GS (China). Inst. of Modern Physics. Jun 1990. In *IMP annual report, 1988 (January-December)*. 138p. Order Number DE91606195. Source: NTIS (US Sales Only), PC A07/MF A01; OSTI; INIS.

Published in summary form only. INCOMPLETE FUSION REACTIONS/ion collisions; PRECOMPOUND-NUCLEUS EMISSION/heavy ion fusion reactions; COMPOUND NUCLEI; EMISSION; HEAVY IONS; LINEAR MOMENTUM TRANSFER; NICKEL 60 REACTIONS; PROJECTILES

54142 (CNIC-I–004, pp. 12) **A dynamic model for heavy-ion reactions.** Wang Zhengda. China Nuclear Information Centre, Beijing, BJ (China); Academia Sinica, Lanzhou, GS (China). Inst. of Modern Physics. Jun 1990. In *IMP annual report, 1988 (January-December)*. 138p. Order Number DE91606195. Source: NTIS (US Sales Only), PC A07/MF A01; OSTI; INIS.

Published in summary form only. HEAVY ION REACTIONS/dynamics; ANGULAR MOMENTUM; CORRELATIONS; EXCITATION; HAMILTONIANS; DYNAMICS; HEAVY IONS; ION COLLISIONS; MOTION; NUCLEAR FRAGMENTS; NUCLEAR MODELS; NUCLEAR POTENTIAL; PROJECTILES; TRAJECTORIES

54143 (CNIC-I–004, pp. 12-13) **Simulation of LMT on projectile break-up.** Qian Xin; Dai Guangxi; Li Zuyu. China Nuclear Information Centre, Beijing, BJ (China); Academia Sinica, Lanzhou, GS (China). Inst. of Modern Physics. Jun 1990. In *IMP annual report, 1988 (January-December)*. 138p. Order Number DE91606195. Source: NTIS (US Sales Only), PC A07/MF A01; OSTI; INIS.

Published in summary form only. LINEAR MOMENTUM TRANSFER/breakup reactions; DISTRIBUTION; DYNAMICS; LAGRANGIAN FUNCTION; PROJECTILES; SIMULATION; THREE-BODY PROBLEM

54144 (CNIC-I–004, pp. 15) **Heavy ion fragmentation calculation at intermediate energies.** Feng Jun; Shen Wenqing; Wang Bing; Zhu Yongtai; Zhan Wenlong; Zhou Jianqun. China Nuclear Information Centre, Beijing, BJ (China); Academia Sinica, Lanzhou, GS (China). Inst. of Modern Physics. Jun 1990. In *IMP annual report, 1988 (January-December)*. 138p. Order Number DE91606195. Source: NTIS (US Sales Only), PC A07/MF A01; OSTI; INIS.

Published in summary form only. NUCLEAR FRAGMENTATION/heavy ions; A CODES; ABLATION; ABRASION; ARGON; CHARGE DISTRIBUTION; GEOMETRY; GIANT RESONANCE; MASS DISTRIBUTION; NUCLEAR MODELS; TANTALUM

54145 (CNIC-I–004, pp. 16-17) **Influence of pauli blocking effect on fragmentation process.** Xi Hongfei; Zhu Yongtai. China Nuclear Information Centre, Beijing, BJ (China); Academia Sinica, Lanzhou, GS (China). Inst. of Modern Physics. Jun 1990. In *IMP annual report, 1988 (January-December)*. 138p. Order Number DE91606195. Source: NTIS (US Sales Only), PC A07/MF A01; OSTI; INIS.

Published in summary form only. NUCLEAR FRAGMENTATION/channeling; CROSS SECTIONS; DISTRIBUTION; HEAVY ION REACTIONS; LINEAR MOMENTUM; CHANNELING; NUCLEAR FRAGMENTS; NUCLEI; PAULI PRINCIPLE; PROJECTILES; TARGETS

54146 (CNIC-I–004, pp. 30-31) **A Monte-Carlo code simulating sequential decay of excited primary products in heavy ion reactions.** Hu Xiaoqing; Zhu Yongtai. China Nuclear Information Centre, Beijing, BJ (China); Academia Sinica, Lanzhou, GS (China). Inst. of Modern Physics. Jun 1990. In *IMP annual report, 1988 (January-December)*. 138p. Order Number DE91606195. Source: NTIS (US Sales Only), PC A07/MF A01; OSTI; INIS.

Published in summary form only. HEAVY ION REACTIONS/nuclear fragments; NUCLEAR DECAY/monte carlo method; COMPUTER CODES; SIMULATION

54147 (CNIC-I–004, pp. 20-21) **The deviation width of out-of-reaction plane of fission fragments in ^{28}Si + ^{197}Au system.** Dai Guangxi (Academia Sinica, Lanzhou, GS (China). Inst. of Modern Physics); Qi Yujin; Zheng Jiwen; Liu Ximin; Chan, Y.; Stokstad, R.; Harmon, A.; Pouliot, J.; Digregorio, D. China Nuclear Information Centre, Beijing, BJ (China); Academia Sinica, Lanzhou, GS (China). Inst. of Modern Physics. Jun 1990. In *IMP annual report, 1988 (January-December)*. 138p. Order Number DE91606195. Source: NTIS (US Sales Only), PC A07/MF A01; OSTI; INIS.

Published in summary form only. FISSION FRAGMENTS/data covariances; GOLD 197 TARGET/silicon 28 reactions; ENERGY DEPENDENCE; EXCITATION; EXPERIMENTAL DATA; NUCLEONS; SPATIAL DISTRIBUTION

54148 (CNIC-I–004, pp. 21-22) **The angular distributions of incomplete fusion fission and sequential fission in ^{28}Si + ^{197}Au system.** Dan Guangxi (Academia Sinica, Lanzhou, GS (China). Inst. of Modern Physics); Qi Yujin; Zheng Jiwen; Liu Ximin; Chan, Y.; Stokstad, R.; Harmon, A.; Pouliot, J.; Digregorio, D. China Nuclear Information Centre, Beijing, BJ (China); Academia Sinica, Lanzhou, GS (China). Inst. of Modern Physics. Jun 1990. In *IMP annual report, 1988 (January-December)*. 138p. Order Number DE91606195. Source: NTIS (US Sales Only), PC A07/MF A01; OSTI; INIS.

Published in summary form only. FISSION/angular distribution; GOLD 197 TARGET/silicon 28 reactions; INCOMPLETE FUSION REACTIONS/angular distribution; CYCLOTRONS; EXPERIMENTAL DATA; FISSION; INCIDENCE ANGLE; LAWRENCE BERKELEY LABORATORY

54149 (CNIC-I–004, pp. 14-15) **Two-parameter rotating liquid drop model.** Xu Shuwei; Pan Qiangyan; Liu Guoxing. China Nuclear Information Centre, Beijing, BJ (China); Academia Sinica, Lanzhou, GS (China). Inst. of Modern Physics. Jun 1990. In *IMP annual report, 1988 (January-December)*. 138p. Order Number DE91606195. Source: NTIS (US Sales Only), PC A07/MF A01; OSTI; INIS.

Published in summary form only. FISSION BARRIER/liquid drop model; ANGULAR MOMENTUM; CENTER-OF-MASS SYSTEM; DISTANCE; FISSION FRAGMENTS; MOMENT OF INERTIA; MULTI-PARAMETER ANALYSIS; NUCLEI; SHAPE

54150 (CNIC-I–004, pp. 18-19) **The sequential fission in ^{28}Si + ^{197}Au systems.** Dai Guangxi (Academia Sinica, Lanzhou, GS (China). Inst. of Modern Physics); Qi Yujin; Zheng Jiwen; Liu Ximin; Chan, Y.; Stokstad, R.; Harmon, A.; Pouliot, J.; Digregorio, D. China Nuclear Information Centre, Beijing, BJ (China); Academia Sinica, Lanzhou, GS (China). Inst. of Modern Physics. Jun 1990. In *IMP annual report, 1988 (January-December)*. 138p. Order Number DE91606195. Source: NTIS (US Sales Only), PC A07/MF A01; OSTI; INIS.

Published in summary form only. GOLD 197 TARGET/silicon 28 reactions; LINEAR MOMENTUM TRANSFER/fission; ANGULAR DISTRIBUTION; CYCLOTRONS; EXPERIMENTAL DATA; FISSION FRAGMENTS; LAWRENCE BERKELEY LABORATORY; FISSION

54151 (CTA-IEAv-RP–033/88) **Cluster model calculations of alpha decays across the periodic table.** Merchant, A.C. (Oxford Univ. (UK). Dept. of Theoretical Physics); Buck, B. Centro Tecnico Aeroespacial (CTA-IEAv), Sao Jose dos Campos, SP (Brazil). Inst. de Estudos Avancados. Oct 1988. 16p. Order Number DE91605469. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

The cluster model of Buck, Dover and Vary has been used to calculate partial widths for alpha decay from the ground states of all nuclei for which experimental measurements exist. The cluster-core potential is represented by a simple three-parameter form having fixed diffuseness, a radius which scales as $A^{1/3}$ and a depth which

is adjusted to fit the Q-value of the particular decay. The calculations yield excellent agreement with the vast majority of the available data, and some typical examples are presented. (author).

54152 (DOE/ER/40299-3) **[Nuclear structure theory relevant to modern probes]: Progress report.** Zamick, L. Rutgers-the State Univ., New Brunswick, NJ (USA). Dept. of Physics. [1986]. 13p. Sponsored by U.S. DOE Energy Research. DOE Contract FG05-86ER40299. Order Number DE91001638. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

This paper is divided into three broad categories: Spin Physics in Nuclei; Surprising Near Degeneracies; and Incompressibility, Isotope Shifts and Breathing Mode States.

54153 (DOE/ER/40335-5) **Theoretical nuclear physics: Progress report, October 1, 1989-October 1, 1990.** Kunz, P.D. Colorado Univ., Boulder, CO (USA). Oct 1990. 53p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-87ER40335. Order Number DE91000979. Source: NTIS, PC A04/MF A01; OSTI; INIS; GPO Dep.

This report contains small papers on the following topics: ground state correlations of nuclei in relativistic random phase approximation; instability of infinite nuclear matter in the relativistic hartree approximation; charge density differences for nuclei near ^{208}Pb in relativistic models; meson exchange current corrections to magnetic moments in quantum hadro-dynamics; analysis of the $O^+ \rightarrow O^-$ reaction at intermediate energies; contributions of reaction channels to the ^{6}Li(p,γ)^{7}Be Reaction; deformed chiral nucleons; vacuum polarization in a finite system; second order processes in the (e,e'd) reaction; sea contributions in Dirac RPA for finite nuclei; and momentum cutoffs in the sea.

54154 (DOE/ER/40427-8-N90) **Models of nucleons in nuclei.** Miller, G.A. Washington Univ., Seattle, WA (USA). Dept. of Physics. [1990]. 18p. Sponsored by U.S. DOE Energy Research. DOE Contract FG06-88ER40427. (CONF-9005233-7: 2. international conference on medium- and high-energy nuclear physics, Taipei (Taiwan), 8-18 May 1990). Order Number DE91001147. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

I discuss models of nuclear deep inelastic scattering and Drell-Yan processes. A combination of binding Fermi motion pion excess and shadowing effects allows one to reproduce the qualitative features of both data sets.

54155 (GANIL-P-8920) **Diving into the spinodal region.** Cussol, D. (Grand Accelerateur National d'Ions Lourds (GANIL), 14 - Caen (FR)); Suraud, E.; Gregoire, C.; Pi, M. Grand Accelerateur National d'Ions Lourds (GANIL), 14 - Caen (France). Aug 1989. 5p. Contract DE-FG02-88ER40388. Order Number DE91716320. Source: NTIS (US Sales Only), PC A02/MF A01.

The spinodal decomposition of heavy-ion induced nuclear systems is analyzed with help of Landau-Vlasov simulations. Estimates of the multifragmentation cross-sections are given, in the framework of a schematic model.

54156 (GANIL-P-8925) **Transport theory of fluctuation phenomena in nuclear collisions.** Ayik, S. (Tennessee Technological Univ., Cookeville, TN (US)); Gregoire, C. Grand Accelerateur National d'Ions Lourds (GANIL), 14 - Caen (France). Nov 1989. 29p. Contract DE-FG05-89ER40350. Order Number DE91716316. Source: NTIS (US Sales Only), PC A03/MF A01.

An extension of the single-particle transport theory is proposed to allow calculation of fluctuation phenomena in nuclear collisions. Instead of neglecting the high order correlations in the equation of motion for the single-particle density, they are retained and treated statistically. As a result, correlations appear as a random force in the equation of motion, in much as the same way as in a Langevin equation for a stochastic processes. It turns out, consistent with the fluctuation-dissipation theorem of statistical mechanics, the correlation function of the random force, which measures the local fluctuations in density, is entirely determined by the average properties of density. The resultant stochastic transport equation describes a diffusive evolution of trajectories of density in an abstract space of all single-particle densities. A preliminary numerical calculation is presented, and implications are discussed.

54157 (IFUSP-P-811) **Color Van der Waals force acting in heavy-ion scattering at low energies.** Hussein, M.S. (Sao Paulo Univ., SP (Brazil). Inst. de Fisica); Lima, C.L.; Pato, M.P.; Bertulani, C.A. Sao Paulo Univ., SP (Brazil). Inst. de Fisica. Nov 1989. 10p. Order Number DE91605441. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

The influence of the color Van der Waals force in the elastic scattering of ^{208}Pb on ^{208}Pb at subbarrier energies is studied. The conspicuous changes in the Mott oscillation found here is suggested as a possible experimental test. (author).

54158 (IFUSP-P-822) **Theory of fragment production in heavy-ion reactions.** Carlson, B.V. (Centro Tecnico Aeroespacial, Sao Jose dos Campos, SP (Brazil). Inst. de Estudos Avancados); Mastroleo, R.C.; Hussein, M.S. Sao Paulo Univ., SP (Brazil). Inst. de Fisica. Jan 1990. 15p. Order Number DE91605442. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

A model for the yield of projectile-like fragments in intermediate and high energy heavy-ion reactions is developed within the Hussein-McVoy formalism. The primary yield of the spectator particle b is found to have the simple form $P_b = \Pi/\sigma^2 \Sigma^{\infty}_{j=0}(1-T^b_j(\sigma))T^x_j(\sigma)$ where σ is the width of the Gaussian wave function describing intrinsic motion of the projectile a, x =a-b is the participant particle and the T,s are Fermi motion-modified transmission coefficients. Reasonable account of the projectile-like fragment production, considered as a secondary yield, in the reaction ^{16}O + ^{208}Pb at 20 MeV/A and 2 GeV/A is obtained when further geometrical restriction on P_b is imposed and b is allowed to decay statistically. (author).

54159 (IFUSP-P-826) **The structure of ^{11}Li : A 'Rydberg' nucleus.** Frederico, T. (Washington Univ., Seattle, WA (USA). Inst. for Nuclear Theory); Hussein, M.S. Sao Paulo Univ., SP (Brazil). Inst. de Fisica. Feb 1990. 7p. Order Number DE91605405. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

The effective long range R^{-2} interaction between ^{9}Li and the two neutrons (slightly bound) is taken here responsible for the loosely bound ^{11}Li nucleus. A large number of these loosely bound Rydberg states is expected to be generated. Similarities to Efimov states are pointed out. (author).

54160 (KURRI-TR-333, pp. 37-42) **Attempts to improve nuclear mass formulas and β-decay theory.** Yamada, M. (Waseda Univ., Tokyo (Japan). Science and Engineering Research Lab.). Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst. Apr 1990. (In Japanese). (CONF-9001108-: 2. specialist research meeting on studies of nuclear chemistry and nuclear physics at research reactor, Kumatori (Japan), 17-18 Jan 1990). In *Proceedings of the 2nd specialist research meeting on studies of nuclear chemistry and nuclear physics at research reactor.* 101p. Order Number DE90513872. Source: NTIS (US Sales Only), PC A06/MF A01.

Published in summary form only. MASS FORMULAE/beta-minus decay; MASS FORMULAE/beta-plus decay; SHELL MODELS; HALF-LIFE; Q-VALUE; STRENGTH FUNCTIONS; SUM RULES; NUCLEON-NUCLEON POTENTIAL; GAMOW-TELLER RULES

54161 (KURRI-TR-333, pp. 49-53) **New problems involved in the mass distribution of fission in the actinide region.** Baba, Hiroshi (Osaka Univ., Toyonaka (Japan). Faculty of Science). Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst. Apr 1990. (In Japanese). (CONF-9001108-: 2. specialist research meeting on studies of nuclear chemistry and nuclear physics at research reactor, Kumatori (Japan), 17-18 Jan 1990). In *Proceedings of the 2nd specialist research meeting on studies of nuclear chemistry and nuclear physics at research reactor.* 101p. Order Number DE90513872. Source: NTIS (US Sales Only), PC A06/MF A01.

Published in summary form only. FISSION FRAGMENTS/mass spectra; BINARY FISSION; THERMAL FISSION; FAST FISSION; THORIUM 232; URANIUM 233; URANIUM 235; URANIUM 238; PLUTONIUM 239; CALIFORNIUM 252; SPONTANEOUS FISSION; ASYMMETRY

54162 **Absorptive model of kaon photoproduction.** Workman, R.L. (Department of Physics, Blacksburg, Virginia (USA)). *Physical Review, C (Nuclear Physics) (USA),* 42(2): 781-783 (Aug 1990). DOE Contract AS05-76ER04928.

The absorptive kaon photoproduction model of Tanabe, Kohno, and Bennhold is examined. It is found that this model predicts the wrong sign for the target polarization observable. It is further found that this problem can be remedied within the model's original form. The model is therefore quite flexible. Comparisons are made with recent calculations.

54163 The level structure, spins and parties of ^{223}Ac. Sheline, R.K. (Florida State Univ., Tallahassee, FL (US)); Sood, P.C.; Liang, C.F.; Paris, P.; Hoff, R.W. *Modern Physics Letters B (USA)*, 5(14): 2833-2838 (20 Jul 1990).

The spin-parity assignments of ^{223}Ac are discussed based on a critical reexamination of the experimental data and the theoretical calculations.

6540 Radiation and Shielding Physics

Refer also to citation(s) 52785, 52904, 53237, 53268, 53320, 53321, 53322, 53324, 53325, 53326, 53327, 53329, 53330, 53598, 54072, 54375

54164 (CTA-IEAv-RP–015/86) **A method for accurate computation of elastic and discrete inelastic scattering transfer matrix.** Garcia, R.D.M.; Santina, M.D. Centro Tecnico Aeroespacial (CTA-IEAv), Sao Jose dos Campos, SP (Brazil). Inst. de Estudos Avancados. May 1986. 28p. Order Number DE91605386. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

A method for accurate computation of elastic and discrete inelastic scattering transfer matrices is discussed. In particular, a partition scheme for the source energy range that avoids integration over intervals containing points where the integrand has discontinuous derivative is developed. Five-figure accurate numerical results are obtained for several test problems with the TRAMA program which incorporates the porposed method. A comparison with numerical results from existing processing codes is also presented. (author).

54165 (CTA-IEAv-RP–035/88) **Temperatures determined from neutron emission in nucleus-nucleus collisions.** Galonsky, A. (Michigan State Univ., East Ealing, MI (USA). Dept. of Physics); Caskey, G.; Heilbronn, L.; Schelin, H.; Remington, B.; Deak, F.; Kiss, A.; Seres, Z.; Kasagi, J. Centro Tecnico Aeroespacial (CTA-IEAv), Sao Jose dos Campos, SP (Brazil). Inst. de Estudos Avancados. Oct 1988. 13p. Order Number DE91605387. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

Most neutron spectra from $^{14}N + {}^{165}Ho$ collisions at 35 MeV/nucleon are described by two moving thermal sources, one at a temperature of approx.2.5 MeV and the other of approx.8 MeV. Resonances in the fragment-neutron relative velocity spectra are used to determine a temperature from the relative populations of excited states of ^{13}C nuclei. There is a discrepancy with the equilibrium assumption in that the fitted value, approx. 1 MeV, does not match that of either thermal source. (author).

54166 (IPEN-PUB–297) **Search for neutron emission during the electrolysis of heavy water.** Coelho, P.R.P.; Saxena, R.N.; Morato, S.P.; Goldman, I.D.; Pinho, A.G. de; Nascimento, I.C. Instituto de Pesquisas Energeticas e Nucleares (IPEN), Sao Paulo, SP (Brazil). Mar 1990. 11p. Order Number DE91605388. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

A liquid scintillator detector NE 213 with pulse shape discrimination technique was used to observe neutrons during the electrolysis of heavy water with a palladium cathode. From the measured fore and background couting rates, a neutron emission rate of $(8.2 \pm 2.9) \times 10^{-3}$ n/(sec.g.) Pd was determined implying $(2.9 \pm 1.0) \times 10^{-24}$ fusions /[(dd pair).sec.] as compared to $\simeq 10^{-23}$ fusion/[(dd pair).sec.] reported by Jones et al. using titanium electrode. (author).

54167 Neutron scattering methods for materials science. Pynn, R. (Neutron Scattering Center, Los Alamos National Lab., Los Alamos, NM (US)). pp. 15-26 of Neutron scattering for materials science. Materials Research Society proceedings: Volume 166. Shapiro, S.M.; Moss, S.C.; Jorgensen, J.D. Materials Research Society, Pittsburgh, PA (USA) (1990). pp. 499 (CONF-891119–: Materials Research Society fall meeting, Boston, MA (USA), 27 Nov - 2 dec 1989).

This article describes some of the neutron scattering techniques which can be used to probe structures of materials on length scales which range from less than 1 Å to 1 μm. The intent is to remove the veils of secrecy and mystery which have apparently prevented the wide application of these techniques to problems in materials science.

54168 Neutrons: The kinder, gentler probe of condensed matter. Axe, J.D. (Brookhaven National Lab., Upton, NY (US)). pp. 3-14 of Neutron scattering for materials science. Materials Research Society proceedings: Volume 166. Shapiro, S.M.; Moss, S.C.; Jorgensen, J.D. Materials Research Society, Pittsburgh, PA (USA) (1990). pp. 499 (CONF-891119–: Materials Research Society fall meeting, Boston, MA (USA), 27 Nov - 2 dec 1989).

This paper reports how neutrons play an increasingly important role in the characterization of advanced modern materials. They provide information that complements rather than competes with that provided by other scattering probes. Although neutrons require heroic efforts to produce, the techniques for using them are not particularly difficult, and with the advent of sufficient user friendly facilities, are becoming a routine tool in the arsenal of expanding numbers of materials scientists.

54169 Real space method of powder diffraction for non-periodic and nearly periodic materials. Egami, T. (Dept. of Materials Science and Engineering, Univ. of Pennsylvania, Philadelphia, PA (US)); Toby, B.H.; Dmowski, W.; Janot, C.; Jorgensen, J.D. pp. 75-80 of Neutron scattering for materials science. Materials Research Society proceedings: Volume 166. Shapiro, S.M.; Moss, S.C.; Jorgensen, J.D. Materials Research Society, Pittsburgh, PA (USA) (1990). pp. 499 (CONF-891119–: Materials Research Society fall meeting, Boston, MA (USA), 27 Nov - 2 dec 1989).

The use of high-energy neutrons from pulsed or hot sources allows the method of atomic pair distribution analysis to be applied to the structural determination of crystalline as well as amorphous solids. This method complements the standard crystallographic methods in studying non-periodic aspects of solids with or without long range order.

54170 Neutron irradiated uranium silicides studied by neutron diffraction and Rietveld analysis. Birtcher, R. (Argonne National Lab., IL (US)); Mueller, M.; Richardson, J. Jr.; Faber, J. Jr. pp. 437-442 of Neutron scattering for materials science. Shapiro, S.M.; Moss, S.C.; Jorgensen, J.D. Materials Research Society, Pittsburgh, PA (USA) (1990). pp. 499 (CONF-891119–: Materials Research Society fall meeting, Boston, MA (USA), 27 Nov - 2 dec 1989).

Uranium silicides have been considered for use as reactor fuels in both high power and low enrichment applications. However, U_3Si was found to become amorphous under irradiation and to become mechanically unstable to rapid growth by plastic flow. U_3Si_2 appears to be stable against amorphization at low displacement rates, but the extent of this stability is uncertain. Although the mechanisms responsible for plastic flow in U_3Si and other amorphous systems are unknown, as is the importance of crystal structure for amorphization, it may not be surprising that these materials amorphize, in light of the fact that many radioactive nuclide-containing minerals are known to metaminctize (lose crystallinity) under irradiation. The present experiment follow the detailed changes in the crystal structures of U_3Si and U_3Si_2 introduced by neutron bombardment and subsequent uranium fission at room temperature.

54171 Directional effects on the motion of swift ions in anisotropic media. Crawford, O.H. (Health and Safety Research Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831-6123 (USA)). *Physical Review, A (General Physics) (USA)*, 42(3): 1390-1395 (1 Aug 1990). DOE Contract AC05-84OR21400.

Directional effects on the motion of swift ions in anisotropic media are studied. The stopping power is a function of the direction of the velocity relative to the principal axes of the medium, and there is a nonzero lateral force on the ion tending to bend its trajectory. These effects arise from the anisotropy of the dielectric response, and are distinct from channeling. Simple expressions are derived for the stopping power and lateral force in the nonrelativistic, high-velocity limit, and results are presented for crystalline graphite.

6550 Medical Physics

Refer also to citation(s) 52894, 53553, 53572, 53817, 53833

54172 (CDTN–ASPC.CN-001/89, pp. 158-172) **Semi-annual report of the radiological protection program - July to December 1988.** Centro de Desenvolvimento da Tecnologia Nuclear (CDTN), Belo Horizonte, MG (Brazil). 1989. (In Portuguese). In *Semi-annual report of Nuclear Technology and Development Center (CDTN) - July to December 1988.* 353p. Order Number DE91606188. Source: NTIS (US Sales Only), PC A16/MF A01; OSTI; INIS.

The activities developed during the second semester of 1988 and the necessities of CDTN, INB and external companies are presentd. (E.G.).

54173 (CNIC–00302) **Environmental aspects and public exposure doses of airborne radioactive effluents from a PWR-power plant.** Song Miaofa (Suzhou Medical Coll., JS (China)); Zhang Jin; Fu Rongchu; Hu Yinxiu. China Nuclear Information Centre, Beijing, BJ (China). Apr 1989. 14p. (In Chinese). (SMC–0031). Order Number DE91605844. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

It is estimated that the environmental aspects and public exposure doses of airborne radioactive effluents from a imaginary 0.3 GW PWR-power plant which sited on the site of a large coalfired power plant estimated before. The major contributor to public exposure is found to be the release of ^{14}C and the critical pathway is food ingestion. A maximum annual individual body effective dose equivalent of 7.112×10^{-6} Sv · $(GW \cdot a)^{-1}$ is found at the point of 0.5 km southeast of the source. The collective dose equivalent in the area around the plant within a radius of 100 km is to be 0.5974 man-Sv · a^{-1}. Both maximum individual and collective effective dose equivalents of the PWR-power plant are much lower than those of the coal-fired one. If the ash emission ratio of the latter decreases from 24.6% to 1%, public exposure doses of the two plants would be nearly equal.

54174 (CNIC-I–004, pp. 98-99) **Program GAMA0001 run on IBM compatible personal computer for analyzing and processing the spectrum of γ-ray.** Zhao Xingyuan. China Nuclear Information Centre, Beijing, BJ (China); Academia Sinica, Lanzhou, GS (China). Inst. of Modern Physics. Jun 1990. In *IMP annual report, 1988 (January-December).* 138p. Order Number DE91606195. Source: NTIS (US Sales Only), PC A07/MF A01; OSTI; INIS.

Published in summary form only. GAMMA SPECTRA/data processing; HIGH-PURITY GE DETECTORS/gamma spectra; DATA ACQUISITION; G CODES; GAUSS FUNCTION; IBM COMPUTERS; PEAKS

54175 (CNIC-I–004, pp. 112) **Limit of α^{2+} beam intensity on HIRFL.** Zhu Lianfang. China Nuclear Information Centre, Beijing, BJ (China); Academia Sinica, Lanzhou, GS (China). Inst. of Modern Physics. Jun 1990. In *IMP annual report, 1988 (January-December).* 138p. Order Number DE91606195. Source: NTIS (US Sales Only), PC A07/MF A01; OSTI; INIS.

Published in summary form only. HIRFL CYCLOTRON/radiation protection; NUCLEAR REACTION YIELD/mathematical models; ALPHA BEAMS; ION BEAMS; NUCLEAR REACTIONS; TARGETS

54176 (CNIC-I–004, pp. 113) **The determination of environment background radiation in IMP.** Liu Yuyan; Wang Guiling; Wei Zengquan. China Nuclear Information Centre, Beijing, BJ (China); Academia Sinica, Lanzhou, GS (China). Inst. of Modern Physics. Jun 1990. In *IMP annual report, 1988 (January-December).* 138p. Order Number DE91606195. Source: NTIS (US Sales Only), PC A07/MF A01; OSTI; INIS.

Published in summary form only. BACKGROUND RADIATION/radiation monitoring; BUILDINGS; CHINA; COSMIC RADIATION; ENVIRONMENT; GAMMA RADIATION

54177 (CNIC-I–004, pp. 114) **γ personal monitoring.** Liu Yuyan; Wang Guiling; Wei Zengquan. China Nuclear Information Centre, Beijing, BJ (China); Academia Sinica, Lanzhou, GS (China). Inst. of Modern Physics. Jun 1990. In *IMP annual report, 1988 (January-December).* 138p. Order Number DE91606195. Source: NTIS (US Sales Only), PC A07/MF A01; OSTI; INIS.

Published in summary form only. RADIOLOGICAL PERSONNEL/radiation monitoring; DOSE EQUIVALENTS; GAMMA RADIATION; RADIATION DOSES; THERMOLUMINESCENT DOSEMETERS

54178 (CNIC-I–004, pp. 116-118) **The calculation of neutron spectrum behind water tank.** Wei Zengquan. China Nuclear Information Centre, Beijing, BJ (China); Academia Sinica, Lanzhou, GS (China). Inst. of Modern Physics. Jun 1990. In *IMP annual report, 1988 (January-December).* 138p. Order Number DE91606195. Source: NTIS (US Sales Only), PC A07/MF A01; OSTI; INIS.

Published in summary form only. NEUTRON SPECTROSCOPY/algorithms; ENERGY LEVELS; FAST NEUTRONS; MONTE CARLO METHOD; ALGORITHMS; RADIATION PROTECTION; SHIELDS; SLOW NEUTRONS; THICKNESS; WATER

54179 (MAFF-FRDR–15) **An assessment of radiation exposure due to liquid effluents from Hinkley Point power stations.** Camplin, W.C.; Austin, L.S.; Eaton, T.E. Ministry of Agriculture, Fisheries and Food, Lowestoft (UK). Directorate of Fisheries Research. 1989. 48p. Order Number DE91605847. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

An assessment is made of the radiological impact of radionuclides discharged from the Hinkley Point site from liquid effluents generated by the existing A and B nuclear stations and the proposed C station. Computer models are used in the assessment. Doses to individual members of the public, who are representative of the most exposed in the population, are predicted to be about 0.04 mSv $year^{-1}$ for the 'best estimate' of discharges from the A, B and C stations. In the worst case, with A and B stations discharging at their authorised limits, and with pessimistic estimates of C station discharges, the individual doses could rise to 0.17 mSv $year^{-1}$. The predicted doses, from the combined effects of liquid and airborne discharges from the Hinkley site and other radionuclide inputs into the Severn Estuary, are considerably less than the ICRP-recommended limit of 1 mSv $year^{-1}$ and target of 0.5 mSv $year^{-1}$ accepted as government policy. Collective doses from liquid effluents are predicted to be less than, or approximately equal to, 12 man-Sv per year of operation of all three stations and are small compared with doses from natural radiation. The radiation effects of the discharges from the Hinkley Point site on marine fauna and seabirds are estimated and shown to be insignificant. (author).

54180 (PB–90-260589/XAB) **Annual report on the administration of the Radiation Control for Health and Safety Act of 1968, Public Law 90-602, April 1, 1990. Report for January-December 1989.** Food and Drug Administration, Rockville, MD (USA). Center for Devices and Radiological Health. 1 Apr 1990. 68p. (FDA/CDRH–90/54). Source: NTIS, PC A04/MF A01.

See also report for 1988, PB–90-171562.

The Food and Drug Administration, through its Center for Devices and Radiological Health, is responsible for the day-to-day administration of the Radiation Control for Health and Safety Act of 1968. The report provides a summary of the operations of the Center in carrying out that responsibility for calendar year 1989. In reviewing the operations of the Center for Devices and Radiological Health as reported in the document, it should be kept in mind that the day-to-day administration of the Act is only part of the Center's function. Other responsibilities include the administration and enforcement of the 1976 Medical Device Amendments to the Federal Food, Drug, and Cosmetic Act (not covered in the report). Manufacturers of electronic products are required by 21 CFR 1003.20 to report accidental radiation occurrences to the Center for Devices and Radiological Health. The Center no longer maintains a Radiation Incidents Registry, since accidental radiation occurrences are reported through the Device Experience Network (DEN) and through the requirements of the Medical Device Reporting (MDR) regulations.

54181 **Limits for exposure to hot particles on the skin.** 54p. National Council on Radiation Protection and Measurements, Bethesda, MD (USA) (1989).

Technical Report NCRP 106.

This report addresses the potential biological effects of hot particles on the skin and reviews the presently available information on

the subject. This information is presently less complete than one would wish, and more information is to be expected in the near future. The report makes recommendations on limits of exposure from hot particles in the work place based on avoidance of severe deterministic effects.

54182 **Radiation protection for medical and allied health personnel.** 129p. National Council on Radiation Protection and Measurements, Bethesda, MD (USA) (1989).

Technical Report NCRP 105.

The primary objective of this new report is to update the material to include new radiation sources used in medicine. In addition, an attempt has been made to reflect current practice in medicine and present the material in terms readily understood by an audience, most of whom have limited expertise in radiation protection terminology and principles. This report is intended to cover those sources of ionizing radiation encountered commonly in the clinical environment.

6560 Condensed Matter Physics

Refer also to citation(s) 53210, 53213, 53214, 53216, 53217, 53261, 53268, 53282, 53304, 53315, 53320, 53321, 53322, 53375, 53378, 53388, 53455, 53467, 53500, 53544, 53552, 53963, 54167, 54168, 54169, 54251, 54281, 54283, 54296

54183 (CBPF-NF–002/90) **^{89}Y NMR measurements in ($Dy_x Y_{1-x}$) Fe_2 compounds.** Alves, K.M.B.; Alves, N.; Sampaio, L.C.; Cunha, S.F. da; Guimaraes, A.P. Centro Brasileiro de Pesquisas Fisicas (CBPF), Rio de Janeiro, RJ (Brazil). 1990. 18p. Order Number DE91605068. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

In a previous work ^{89}Y measurements at 4.2 K in ($R_x Y_{1-x}$) Fe_2 compounds with R= Tb and Ho and $0.05 \leq x \leq 0.20$ have shown broad NMR spectra, due to transfered hyperfine interactions. ^{89}Y NMR signals could not be observed with R=Dy in the same composition range. In the present work, compounds were prepared with dysprosium substitution in the concentration range $0.005 \leq x \leq 0.02$ to investigate the origin of this anomaly. (A.C.A.S.).

54184 (CBPF-NF–007/90) **Intrinsic domain wall pinning in Hf ($Fe_{0.5}Al_{0.5}$)$_2$.** Sampaio, L.C.; Cunha, S.F. da. Centro Brasileiro de Pesquisas Fisicas (CBPF), Rio de Janeiro, RJ (Brazil). 1990. 21p. Order Number DE91605069. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

The magnetization vs temperature curve for Hf ($Fe_{0.5}Al_{0.5}$)$_2$ in low applied field presents a maximum and also an irreversibility up to near the Curie temperature. For temperatures lower than 7K a critical field exists in the virgin magnetization curves. An exponential temperature decrease of the coercive field is observed. The time effect in the demagnetization region of the hysteresis loop was measured and it is related to the wall deformation. (A.C.A.S.).

54185 (CBPF-NF–056/89) **^{57}Fe Moessbauer studies on semiconducting and superconducting La-Ba-Cu-O.** Saitovitch, E.B. (Centro Brasileiro de Pesquisas Fisicas (CBPF), Rio de Janeiro, RJ (Brazil)); Scorzelli, R.B.; Azevedo, I.S.; Santos, C.A. dos; Litterst, F.J. Centro Brasileiro de Pesquisas Fisicas (CBPF), Rio de Janeiro, RJ (Brazil). 1989. 19p. Order Number DE91605070. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

$La_{2-x}Ba_xCuO_4$ samples substituted with ^{57}Fe (less than 1%) were studied for $0 <= x <= 0.35$. Despite the fact that there is only one Cu site which can be occupied by the iron-substituent, the ^{57}Fe Moessbauer spectra at room temperature show three quadrupole doublets whose intensities were followed in different steps of sample preparation. They are characteristic of Fe^{3+}, and their Moessbauer parameters depend on the Ba content. One of the iron species may be due to defects since it disappears by further heat treatment, while the others are present even in the undoped La_2CuO_4. Magnetic ordering has been found at 4.2 K for samples with 0.5% Fe even in the superconducting samples with $x = 0.15$. (author).

54186 (CNIC-I–004, pp. 61-62) **Moessbauer study of the support effect of zinc ferrite spinel catalysts.** Chen Xiaoxi; Xiao Guoqing; Shen Shikong; Ji Weijie. China Nuclear Information Centre, Beijing, BJ (China); Academia Sinica, Lanzhou, GS (China). Inst. of Modern Physics. Jun 1990. In *IMP annual report, 1988 (January-December).* 138p. Order Number DE91606195. Source: NTIS (US Sales Only), PC A07/MF A01; OSTI; INIS.

Published in summary form only. CARRIERS/moessbauer effect; CATALYSTS/carriers; CARRIERS; CATALYSTS; FERRITES; IRON-ALPHA; IRON-GAMMA; OXIDATION; PHASE STUDIES; SPINELS; ZINC

54187 (CNIC-I–004, pp. 62-63) **Moessbauer spectroscopy studies of Sm (Co, Cu, Fe, Zr)$_{7.4}$ alloys under the different heat treatment conditions.** Chen Xiaoxi; Xiao Guoqing; Niu Mulin; Li Huiqing. China Nuclear Information Centre, Beijing, BJ (China); Academia Sinica, Lanzhou, GS (China). Inst. of Modern Physics. Jun 1990. In *IMP annual report, 1988 (January-December).* 138p. Order Number DE91606195. Source: NTIS (US Sales Only), PC A07/MF A01; OSTI; INIS.

Published in summary form only. MOESSBAUER EFFECT/samarium base alloys; SAMARIUM BASE ALLOYS/moessbauer effect; CASTING; COBALT ALLOYS; COPPER ALLOYS; IRON ALLOYS; ISOTHERMAL PROCESSES; MAGNETIC PROPERTIES; MICROSTRUCTURE; PHASE STUDIES; SINTERING; ZIRCONIUM ALLOYS

54188 (CNIC-I–004, pp. 65-66) **Moessbauer study of six roasted iron ores.** Xiao Guoqing; Chen Xiaoxi; Liu Jie; Zhen Jinshan. China Nuclear Information Centre, Beijing, BJ (China); Academia Sinica, Lanzhou, GS (China). Inst. of Modern Physics. Jun 1990. In *IMP annual report, 1988 (January-December).* 138p. Order Number DE91606195. Source: NTIS (US Sales Only), PC A07/MF A01; OSTI; INIS.

Published in summary form only. IRON ORES/moessbauer effect; IRON ORES/roasting; ROASTING; IRON OXIDES; LIMONITE; PHASE STUDIES; TEMPERATURE DEPENDENCE

54189 (CNIC-I–004, pp. 58-59) **The depth distribution of damage energy bombarded by high energetic ion.** Chen Jiachao; Chen Keqin; Ma Feng. China Nuclear Information Centre, Beijing, BJ (China); Academia Sinica, Lanzhou, GS (China). Inst. of Modern Physics. Jun 1990. In *IMP annual report, 1988 (January-December).* 138p. Order Number DE91606195. Source: NTIS (US Sales Only), PC A07/MF A01; OSTI; INIS.

Published in summary form only. ENERGY ABSORPTION/spatial distribution; ION BEAMS/energy absorption; DEPTH; H CODES; IRRADIATION; MATHEMATICAL MODELS; MEV RANGE 10-100; MEV RANGE 100-1000; NUCLEAR FORCES; PHYSICAL RADIATION EFFECTS

54190 (CNIC-I–004, pp. 60-61) **Positron lifetime study of proton irradiated Mo.** Zhu Zhiyong; Chen Keqin; Chen Jiachao; Xu Ronghui. China Nuclear Information Centre, Beijing, BJ (China); Academia Sinica, Lanzhou, GS (China). Inst. of Modern Physics. Jun 1990. In *IMP annual report, 1988 (January-December).* 138p. Order Number DE91606195. Source: NTIS (US Sales Only), PC A07/MF A01; OSTI; INIS.

Published in summary form only. MOLYBDENUM/physical radiation effects; POSITRONS/lifetime; ANNIHILATION; CRYSTAL DEFECTS; HYDROGEN; IRRADIATION; MOLYBDENUM; POSITRONS; LIFETIME; PROTON BEAMS; VACANCIES

54191 (CNIC-I–004, pp. 78-79) **A heavy ion beam sputtering device for preparing target in process of construction.** Long Ao; Zhang Guobin; Wang Xiuying; Dou Cunwen; Ge Suxian. China Nuclear Information Centre, Beijing, BJ (China); Academia Sinica, Lanzhou, GS (China). Inst. of Modern Physics. Jun 1990. In *IMP annual report, 1988 (January-December).* 138p. Order Number DE91606195. Source: NTIS (US Sales Only), PC A07/MF A01; OSTI; INIS.

Published in summary form only. SPUTTERING/equipment; SPUTTERING/heavy ions; ION BEAMS; ISOTOPES; SAMPLE PREPARATION; SPECIFICATIONS; SPUTTERING; EQUIPMENT; TARGETS

54192 (CONF-900936–12) **Formation of aluminum films on silicon by ion beam deposition: A comparison with ionized cluster beam deposition.** Zuhr, R.A. (Oak Ridge National Lab.,

TN (USA)); Haynes, T.E.; Galloway, M.D.; Tanaka, S.; Yamada, A.; Yamada, I. Oak Ridge National Lab., TN (USA). [1990]. 13p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From 7. international conference on ion beam modification of materials; Knoxville, TN (USA); 9-14 Sep 1990. Order Number DE91001276. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The direct ion beam deposition (IBD) technique has been used to study the formation of oriented aluminum films on single crystal silicon substrates. In the IBD process, thin film growth is accomplished by decelerating a magnetically-analyzed ion beam to low energies (10–200 eV) for direct deposition onto the substrate under UHV conditions. The energy of the incident ions can be selected to provide the desired growth conditions, and the mass analysis ensures good beam purity. The aluminum on silicon system is one which has been studied extensively by ionized cluster beam (ICB) deposition. In this work, we have studied the formation of such films by IBD with emphasis on the effects of ion energy, substrate temperature, and surface cleanliness. Oriented films have been grown on Si(111) at temperatures from 40° to 300°C and with ion energies from 30 to 120 eV per ion. Completed films were analyzed by ion scattering, x-ray diffraction, scanning electron microscopy, and optical microscopy. Results achieved for thin films grown by IBD are compared with results for similar films grown by ICB deposition. 15 refs., 3 figs.

54193 (CONF-901116–6) **Electron emission during multicharged ion-surface interactions.** Zeijlmans van Emmichoven, P.A. (Oak Ridge National Lab., TN (USA)); Havener, C.C.; Meyer, F.W.; Zehner, D.M. Oak Ridge National Lab., TN (USA). [1990]. 14p. Sponsored by U.S. DOE Energy Research; Joint Institute for Heavy Ion Research. DOE Contract AC05-84OR21400 ;FG05-87ER40361. From 11. international conference on the application of accelerators in research and industry; Denton, TX (USA); 5-8 Nov 1990. Order Number DE91000615. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Recent measurements of electron spectra for slow multicharged N ion-surface collisions are presented. The emphasis is on potential emission, i.e. the electron emission related to the neutralization of the ions. When using N ions that carry a K shell vacancy into the collision, characteristic K Auger electron emission from the projectiles is observed, as well as, for specific surfaces, target atom Auger transitions (resulting from vacancy transfer). Measurements of the intensity of these Auger transitions as a function of the time the ions spend above the surface can serve as a useful probe of the timescales characterizing the relevant neutralization processes. This technique is elucidated with the help of some computer simulations. It is shown that neutralization timescales required in the atomic ladder picture, in which neutralization takes place by resonant capture followed by purely intra-atomic Auger transitions, are too long to explain our experimental results. The introduction of additional neutralization/de-excitation mechanisms in the simulations leads to much better agreement with the experiments.

54194 (CONF-901116–16) **Electron cyclotron resonance microwave ion sources for thin film processing.** Berry, L.A.; Gorbatkin, S.M. Oak Ridge National Lab., TN (USA). [1990]. 17p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From 11. international conference on the application of accelerators in research and industry; Denton, TX (USA); 5-8 Nov 1990. Order Number DE91001524. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Plasmas created by microwave absorption at the electron cyclotron resonance (ECR) are increasingly used for a variety of plasma processes, including both etching and deposition. ECR sources efficiently couple energy to electrons and use magnetic confinement to maximize the probability of an electron creating an ion or free radical in pressure regimes where the mean free path for ionization is comparable to the ECR source dimensions. The general operating principles of ECR sources are discussed with special emphasis on their use for thin film etching. Data on source performance during Cl base etching of Si using an ECR system are presented. 32 refs., 5 figs.

54195 (CONF-8908202–2) **Ultrafast and ultrasensitive dielectric liquids/mixtures: Basic measurements and applications.** Christophorou, L.G. (Oak Ridge National Lab., TN (USA)); Faidas, H.; McCorkle, D.L. Tennessee Univ., Knoxville, TN (USA). [1989]. 28p. Sponsored by U.S. DOE Energy Research. DOE Contract AS05-76ER03956 ;AC05-84OR21400. Contract N00014-89-J-1990. From 6. international swarm seminar; Glen Cove, NY (USA); 3-5 Aug 1989. Order Number DE91001270. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Basic properties of cryogenic and room temperature dielectric liquids/mixtures with high electron yields (under irradiation by ionizing particles) and high excess electron drift velocities are discussed. A number of ultrafast and ultrasensitive liquid media – appropriate for possible use in liquid-filled radiation detectors and other applications – are identified. 44 refs., 12 figs.

54196 (DOE/ER/13235–3) **Photochemical generation of the optoacoustic effect: Progress report.** Diebold, G.J. Brown Univ., Providence, RI (USA). Dept. of Chemistry. Oct 1990. 44p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-84ER13235. Order Number DE91000857. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Research in this period has focussed on the description of the photoacoustic effect generated by small bodies, (or particles) irradiated by short pulse laser radiation. In particular, the effects of the discontinuity in acoustic properties at the interface of the body and its surrounding medium are considered. Calculations were carried out to determine the temporal profile of the photoacoustic waves generated by fluid spheres, cylinders, and layers. Similar calculations were done for a one dimensional Beer's law absorption of radiation. We find that time domain expressions for the photoacoustic waveforms can be expressed in terms of Fourier transform integrals. The temporal profiles of the waveforms depend on the geometry and dimensions of the particle and the sound speed and density ratios between the irradiated particle and its surrounding fluid. Experiments where a Nd:YAG laser irradiates a particle and the ultrasonic wave is detected by a fast polyvinlyidiene fluoride transducer show that the theoretical model is essentially correct in predicting the important features of the waveforms. Additional experiments are reported where an interference effect is observed, and the influence of optical pumping on the electron beam ionization of Na is determined.

54197 (DOE/ER/13865–029) **Luminescence, Raman and absorption spectrophotometric studies of selected lanthanide and actinide compounds in the solid state.** Guillermo Daniel Del Cul. Tennessee Univ., Knoxville, TN (USA). Dec 1990. 140p. Sponsored by U.S. DOE Energy Research. DOE Contract FG05-88ER13865. Order Number DE91000928. Source: NTIS, PC A08/MF A01 - OSTI; GPO Dep.

Raman, absorption and luminescence spectroscopy has been used extensively in our laboratory to recognize crystal structures or to identify changes in the structural pattern of solid compounds at different temperatures and pressures. These techniques have also been employed to determine the chemical environment of f element ions in different compounds and solutions. Polarized Raman spectroscopy was used to assign the Raman-active bands of selected lanthanide oxyhalide single crystals. Cerium oxychloride was synthesized for the first time in the present research. The polarized luminescence, absorbance and electronic Raman spectra from single crystal europium oxychloride, recorded at 300 and 77 K, were measured, interpreted, and used to calculate crystal field parameters. Although a suitable UV excitation source was unavailable, luminescence from the upper levels was obtained by resonance enhanced two-photon excitation. The same techniques were applied to both a collection of coaxial single crystals and polycrystalline europium oxychloride under pressure using a diamond anvil cell. The spectra at high pressure suggest the presence of Eu^{II} ion. The two-photon sequential excitation technique was also employed, for the first time, to study the electronic levels of Cm^{III} and Cf^{III} in trihalides. Such luminescence is often weak due to an efficient nonradiative de-excitation process due to closely spaced energy levels. Nevertheless, because of the low background encountered in two-photon processes, the energy of many levels can be obtained. The effect of pressure on the Raman, absorption and

luminescence spectra of $CmCl_3$ was investigated. The curium trichloride behavior was compared to previous studies on lanthanide trihalides and along with new studies on $NdBr_3$ to confirm the possibility of a new high pressure phase.

54198 (IAERU–8904, pp. 19-40) **Models for the thermoluminescense process in LiF(Mg).** Kitahara, Akiharu (Tokyo Metropolitan Isotope Research Center (Japan)). Rikkyo Univ., Yokosuka, Kanagawa (Japan). Inst. for Atomic Energy. Jan 1990. (In Japanese). (CONF-8906351–: 5. IAERU seminar, Tokyo (Japan), 24 Jun 1989). In *Proceedings of IAERU seminar-V.* 89p. Order Number DE90513828. Source: NTIS (US Sales Only), PC A05/MF A01.

LiF is one of the important thermoluminescence phosphors used for dosimetry as a tissue equivalent material. Magnesium is known to be the major dopant in thermoluminescence LiF. Many investigations have been carried out to understand the role of magnesium and other impurities in the trapping and luminescence recombination process. In this paper, several models for thermoluminescence process in LiF(Mg) are described. These are Mayhugh's band gap model based on the disappearance of the V_3 band and the luminescence recombination process at Ti sites with electrons which have tunnelled from nearby F center, Nink's Z center trapping model based on the thermo-luminescence at main peak as being stimulated by the release of one electron from a Z_2 center, converting this to a Z_3 center, Nepomnyachikh's Mg^+-cation vacancy-anion vacancy center model instead of Z_2 center model and Stoebe's competing trap model based on Mg-OH-vacancy complexes. TL complex model based on the observed changes of TL intensity and emission spectra in LiF: Mg, Cu containing different amount of Mg is proposed. This model is consistent with the view that the trap center and the recombination center are close together within large defects complexes, which could be called thermoluminescent centers. (author).

54199 (IAERU–8904, pp. 41-61) **Thermoluminescent materials.** Yamamoto, Yusuke (Komazawa Junior Coll., Tokyo (Japan). Dept. of Radiology). Rikkyo Univ., Yokosuka, Kanagawa (Japan). Inst. for Atomic Energy. Jan 1990. (In Japanese). (CONF-8906351–: 5. IAERU seminar, Tokyo (Japan), 24 Jun 1989). In *Proceedings of IAERU seminar-V.* 89p. Order Number DE90513828. Source: NTIS (US Sales Only), PC A05/MF A01.

Thermoluminescence is the emission of light from substances when they are heated. This phenomena is observed for many synthetic and natural substances. These thermoluminescent materials must be ionic crystals, covalent crystals, and molecular crystals - an insulator or a semiconductor, but metals do not exhibit luminescent properties because they could not storage radiation energy. Most research has been devoted to the discovery and development of materials suitable for thermoluminescence dosemeters, and some phosphors are used routinely in dosimetric applications. But for other purposes, many interesting materials have been suggested and investigated. (author).

54200 (IAERU–8904, pp. 3-17) **Supralinearity of thermoluminescence.** Harasawa, Susumu (Rikkyo Univ., Yokosuka, Kanagawa (Japan). Inst. for Atomic Energy). Rikkyo Univ., Yokosuka, Kanagawa (Japan). Inst. for Atomic Energy. Jan 1990. (In Japanese). (CONF-8906351–: 5. IAERU seminar, Tokyo (Japan), 24 Jun 1989). In *Proceedings of IAERU seminar-V.* 89p. Order Number DE90513828. Source: NTIS (US Sales Only), PC A05/MF A01.

The report summarizes various features and hypotheses proposed so far concerning the supralinearity of thermoluminescence. TLD-100 (LiF(Mg)) is the most extensively studied substance with respect to the supralinearity of thermoluminescence. Thus, major supralinear characteristics of this substance are outlined first. TLD-100 begins to show supralinearity and increase in sensitivity as the absorbed dose exceeds 10 Gy, but it starts showing saturation and rapidly decreasing in sensitivity as the absorbed dose exceeds 1,000 Gy. The supralinear characteristics of a substance varies with type of the incident radiations. In general, supralinearity decreases with increasing LET of the incident radiations. The shape of the glow curve of TDL-100 largely changes as the absorbed dose becomes large (above 10^3 Gy). However, it is unlikely that the change in the glow curve is associated with the development of supralinearity. If seems also unlikely that the supralinearity could be associated with a change in the emission spectrum. A mathematical model for the electron and positive hole capturing process is proposed and discussed on the assumption that the process consists of a number of sub-processes. (N.K.).

54201 (IC–90/52) **The local structure of Cr^{3+} centre in A_2MF_4 (A=K, Rb, Cs; M=Zn, Cd, Mg) crystals.** Du Maolu (International Centre for Theoretical Physics, Trieste (Italy)); Zhao Minguang. International Centre for Theoretical Physics, Trieste (Italy). Apr 1990. 12p. Order Number DE91605076. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

For three Cr^{3+} centres (the uncompensated Cr^{3+} centre, the Cr^{3+}-Vm and Cr^{3+}-Li^+ centres) in K_2ZnF_4, Rb_2ZnF_4, Rb_2CdF_4, Cs_2CdF_4 and K_2MgF_4 crystals, the local structure parameters of the CrF_6 clusters are determined by using a parameterized d-orbit of Cr^{3+} ions. From the obtained parameters the calculated results for the EPR parameters of the three centres in the crystals are in agreement with the experimental data. (author). 26 refs, 1 fig., 2 tabs.

54202 (IC–90/53) **The eighth-order perturbation formula of zero-field splitting for $3d^5$ ions in D_{3d} site and its application to $CaCO_3$: Mn^{2+}.** Li Fuzhen (International Centre for Theoretical Physics, Trieste (Italy)); Li Zhaomin. International Centre for Theoretical Physics, Trieste (Italy). Apr 1990. 10p. Order Number DE91605077. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

The eighth-order perturbation formula of zero-field splitting parameter D for $3d^5$ configuration in D_{3d} symmetry has been derived in this work. The d-d transition of Mn^{2+} in $MnCO_3$ has been calculated using the d-orbit of Mn^{2+}. The eighth-order perturbation formula has been applied to $CaCO_3$: Mn^{2+}. The result of application agrees well with experiments. (author). 21 refs, 2 tabs.

54203 (IC–90/75) **Possible hysteresis loops of resonator-less optical bistability.** Nguyen Ba An (Institute of Theoretical Physics, Hanoi (Viet Nam)); Le Thi Cat Tuong. International Centre for Theoretical Physics, Trieste (Italy). May 1990. 10p. Order Number DE91605066. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

We qualitatively show that hysteresis loops of intrinsic optical bistability phenomena without any additional feedback may be of various shapes including those of a butterfly and a three-winged bow. (author). 15 refs, 4 figs.

54204 (IC–90/115) **The band structures of superlattices $(Ge_2)_1/(GaAs)_m(110)$ with m=1-20.** Xu Zhinzhong. International Centre for Theoretical Physics, Trieste (Italy). Jun 1990. 20p. Order Number DE91605074. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

The electronic band structures of superlattices $(Ge_2)1/(GaAs)_m(110)$ with m=1-20 were calculated by using the renormalization technique in a tight-binding frame. The results show that the valence band top and the conduction band bottom of the superlattices $(Ge_2)_1/(GaAs)_m(110)$ are not at the same point in the Brillouin zone and the electronic states at the bottom of the conduction band display distinct 2-dimensional character. For the monolayer superlattice $(Ge_2)_1/(GaAs)_1$ both the indirect and direct forbidden bands are very small. As the number of the GaAs layers increases the electronic states at the bottom of the conduction bands transit from 3-dimensional character to 2-dimensional character gradually and the degrees of the transitions are different for each point in the Brillouin zone. The transverse energy dispersion of the lowest conduction band remains unchanged when the number of GaAs layers m increases beyond 10. (author). 9 refs, 8 figs, 4 tabs.

54205 (IC–90/118) **Electron mobility for a Si - $Si_{1-x}Ge_x$ quantum well: acoustic phonon scattering mechanism.** Tutor, J. (International Centre for Theoretical Physics, Trieste (Italy)); Bermudez, J.A.; Comas, F. International Centre for Theoretical Physics, Trieste (Italy). Jun 1990. 23p. Order Number DE91605064. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

Drift mobility is calculated at the low temperature regime along the Si channel of a Si-$Si_{1-x}Ge_x$ quantum well (QW). Boltzmann transport theory is applied assuming electron interaction with

acoustic phonons via the deformation potential mechanism. Infinite potential barriers are supposed at the interface and the electron states are obtained in the effective mass approximation. The acoustic phonon spectrum is treated in the standard 3-D approach using an electron-phonon hamiltonian adapted from the bulk case. Obtained results are compared with experiment. (author). 14 refs, 4 figs.

54206 (IC–90/119) **Resonant Zener tunneling in quantum wells.** Dios Leyva, M. de (Havana Univ., La Habana (Cuba). Dept. of Theoretical Physics); Gondar, J.L. International Centre for Theoretical Physics, Trieste (Italy). Jun 1990. 10p. Order Number DE91605075. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

A theoretical study of Zener tunneling in quantum wells subject to a constant electric field E_L is presented. The analysis is carried out in the framework of a simplified two-band Kane's model. It is shown that the transmission coefficient T(E) as a function of electron energy exhibits a well defined resonant structure. Some interesting properties of T(E) are reported. (author). 14 refs, 2 figs.

54207 (IC–90/161) **Orientational ordering as a possible mechanism for viscosity-enhancement of supercooled liquids.** Dattagupta, S. International Centre for Theoretical Physics, Trieste (Italy). Jul 1990. 6p. Order Number DE91605065. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

A supercooled liquid is viewed to have regions of local orientational order which can be picturized in terms of cages that restrict single particle diffusion. The mismatch in the orientation of two locally ordered neighbouring regions causes an internal stress which is added to the stress that appears in the Maxwell model of viscoelasticity. This leads to a "renormalized" Maxwell time which is related to the susceptibility associated with the orientational order. Hence, when the latter becomes very large, one obtains a large enhancement of the viscosity. (author). 7 refs.

54208 (IFUSP-P–813) **Decay kinetics study of Ag^0 in silver doped barium aluminoborate glasses.** Pontuschka, W.M.; Santos, J.T. dos; Isotani, S.; Rabbani, S.R. Sao Paulo Univ., SP (Brazil). Inst. de Fisica. Dec 1989. 17p. Order Number DE91605078. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

EPR measurements of $30BaO.50B_2O_3.20Al_2O_3$ at. % glasses containing different amounts of silver impurity, X-and γ-irradiated at room temperature, showed the presence of Ag^0 and Ag^{++} centers. Decay kinetics of Ag^0 was determined for different temperatures in glass containing 0.1% of silver. We show that our model of stabilization energy of H^0 in B-O rings through van der Waals forces is not applicable to Ag^0. Thus, we propose the model of reduction of Ag^0 to Ag^+ as the mechanism of the Ag^0 decay kinetics. (author).

54209 (IS-T–1374) **Nonphotochemical hole burning and dispersive kinetics in amorphous solids.** Kenney, M.J. Ames Lab., IA (USA). 21 Sep 1990. 115p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-82. Order Number DE91000668. Source: NTIS, PC A06/MF A01 - OSTI; GPO Dep.

Results covering burn intensities in the nW to $\mu W/cm^2$ range, of dispersive hole growth kinetics are reported for Oxazine 720 in glycerol glasses and polyvinyl alcohol polymer films and their deuterated analogues. A theoretical model which employs a distribution function for the hole burning rate constant based upon a Gaussian distribution for the tunnel parameter is shown to accurately describe the kinetic data. This model incorporates the linear electron-phonon coupling. A method for calculating the nonphotochemical quantum yield is presented which utilizes the Gaussian distribution of tunnel parameters. The quantum yield calculation can be extended to determine a quantum yield as a function of hole depth. The effect of spontaneous hole filling is shown to be insignificant over the burn intensity range studied. Average relaxation rates for hole burning are ~8 orders of magnitude greater than for hole filling. The dispersive kinetics of hole burning are observed to be independent over the temperature range of these experiments, 1.6 to 7.0 K. 6 refs., 20 figs., 1 tab.

54210 (IS-T–1408) **A reciprocal space approach for locating symmetry elements in Patterson superposition maps.** Hendrixson, T. Ames Lab., IA (USA). 21 Sep 1990. 187p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-82. Order Number DE91000665. Source: NTIS, PC A09/MF A01 - OSTI; GPO Dep.

A method for determining the location and possible existence of symmetry elements in Patterson superposition maps has been developed. A comparison of the original superposition map and a superposition map operated on by the symmetry element gives possible translations to the location of the symmetry element. A reciprocal space approach using structure factor-like quantities obtained from the Fourier transform of the superposition function is then used to determine the "best" location of the symmetry element. Constraints based upon the space group requirements are also used as a check on the locations. The locations of the symmetry elements are used to modify the Fourier transform coefficients of the superposition function to give an approximation of the structure factors, which are then refined using the EG relation. The analysis of several compounds using this method is presented. Reciprocal space techniques for locating multiple images in the superposition function are also presented, along with methods to remove the effect of multiple images in the Fourier transform coefficients of the superposition map. In addition, crystallographic studies of the extended chain structure of $(NHC_5H_5)SbI_4$ and of the twinning method of the orthorhombic form of the high-T_c superconductor $YBa_2Cu_3O_{7-x}$ are presented. 54 refs.

54211 (IS-T–1516) **Diagnostic probes for particle and molecule distributions in laser-generated plumes.** Kimbrell, S.M. Ames Lab., IA (USA). 17 Oct 1990. 102p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-82. Order Number DE91001598. Source: NTIS, PC A06/MF A01 - OSTI; GPO Dep.

Laser microprobe analysis (LMA) offers good spatial and depth resolution for solid sampling of virtually any material. Coupled with numerous optical spectroscopic and mass spectrometric detection methods, LMA is a powerful analytical tool. Yet, fundamental understanding of the interaction between the laser and the sample surface leading to the formation of the high temperature plasma (plume) is far from complete. To better understand the process of plume formation, an imaging method based on acousto-optic laser beam deflection has been coupled with light scattering methods and absorption methods to record temporal and spatial maps of the particle and molecule distributions in the plume with good resolution. Because particles can make up a major fraction of the vaporized material under certain operating conditions, they can reflect a large loss of atomic signal for elemental analysis, even when using auxiliary excitation to further vaporized the particles. Characterization of the particle size distributions in plumes should provide insight into the vaporization process and information necessary for studies of efficient particle transfer. Light scattering methods for particle size analysis based on the Mie Theory are used to determine the size of particles in single laser-generated plumes. The methods used, polarization ratio method and dissymmetry ratio method, provide good estimates of particle size with good spatial and temporal resolution for this highly transient system. Large particles, on the order of 0.02-0.2μm in radius, were observed arising directly from the sample surface and from condensation.

54212 (KURRI-TR–330, pp. 90-94) **Irradiation effects on aluminum compounds.** Atobe, Kozo (Naruto Univ. of Education, Tokushima (Japan)). Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst. Mar 1990. (In Japanese). (CONF-8908245–: Workshop on development and application of low temperature irradiation and irradiation facilities; Workshop on development and application of low temperature irradiation and irradiation facilities, Kumatori (Japan); KUMATORI (is not a va In *Proceedings of the workshop on development and application of low temperature irradiation and irradiation facilities*. 145p. Order Number DE90513870. Source: NTIS (US Sales Only), PC A07/MF A01.

Published in summary form only. ALUMINIUM OXIDES/neutron sources; IRRADIATION; PHYSICAL RADIATION EFFECTS; POINT DEFECTS; ANNEALING; F CENTERS; ABSORPTION SPECTRA; THERMOLUMINESCENCE; EMISSION SPECTRA; TEMPERATURE DEPENDENCE

54213 (KURRI-TR–330, pp. 81-82) **Low temperature irradiation of semiconductors.** Fukuoka, Noboru (Naruto Univ. of

Education, Tokushima (Japan)). Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst. Mar 1990. (In Japanese). (CONF-8908245–: Workshop on development and application of low temperature irradiation and irradiation facilities; Workshop on development and application of low temperature irradiation and irradiation facilities, Kumatori (Japan); KUMATORI (is not a va In *Proceedings of the workshop on development and application of low temperature irradiation and irradiation facilities.* 145p. Order Number DE90513870. Source: NTIS (US Sales Only), PC A07/MF A01.

Published in summary form only. SEMICONDUCTOR MATERIALS/irradiation; SEMICONDUCTOR MATERIALS/very low temperature; IRRADIATION; CRYSTAL DEFECTS; ELECTRON BEAMS; INTERSTITIALS; PHOTOLUMINESCENCE; SILICON; MIGRATION LENGTH; CARBON

54214 (KURRI-TR–330, pp. 40-42) **Positron annihilation lifetime measurement of pure iron irradiated by fission and fusion neutrons.** Kuramoto, Eiichi (Kyushu Univ., Kasuga, Fukuoka (Japan). Research Inst. for Applied Mechanics); Takenaka, Minoru. Kyoto Univ., Kumatori,'Osaka (Japan). Research Reactor Inst. Mar 1990. (In Japanese). (CONF-8908245–: Workshop on development and application of low temperature irradiation and irradiation facilities; Workshop on development and application of low temperature irradiation and irradiation facilities, Kumatori (Japan); KUMATORI (is not a va In *Proceedings of the workshop on development and application of low temperature irradiation and irradiation facilities.* 145p. Order Number DE90513870. Source: NTIS (US Sales Only), PC A07/MF A01.

Published in summary form only. IRON/fission neutrons; POSITRON DETECTION/iron; IRON; IRRADIATION; NEUTRON SOURCES; KUR REACTOR; ANNEALING; LIFETIME; THERMONUCLEAR REACTORS

54215 (KURRI-TR–330, pp. 26-30) **Moessbauer study on point defects.** Nasu, Saburo (Osaka Univ., Toyonaka (Japan). Faculty of Engineering Science). Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst. Mar 1990. (In Japanese). (CONF-8908245–: Workshop on development and application of low temperature irradiation and irradiation facilities; Workshop on development and application of low temperature irradiation and irradiation facilities, Kumatori (Japan); KUMATORI (is not a va In *Proceedings of the workshop on development and application of low temperature irradiation and irradiation facilities.* 145p. Order Number DE90513870. Source: NTIS (US Sales Only), PC A07/MF A01.

Published in summary form only. SUPERCONDUCTORS/moessbauer effect; ' SUPERCONDUCTORS/crystal defects; SUPERCONDUCTORS; TEMPERATURE DEPENDENCE; CRYSTAL STRUCTURE; IRON 57; ELECTRIC CONDUCTIVITY; LINEAR ACCELERATORS; IRRADIATION; ELECTRON BEAMS

54216 (KURRI-TR–333, pp. 1-5) **Nuclear polarization of implanted atoms with radiation-detected optical pumping in semiconductors.** Matsuki, Seishi (Osaka Univ., Ibaraki (Japan). Research Center for Nuclear Physics). Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst. Apr 1990. (CONF-9001108–: 2. specialist research meeting on studies of nuclear chemistry and nuclear physics at research reactor, Kumatori (Japan), 17-18 Jan 1990). In *Proceedings of the 2nd specialist research meeting on studies of nuclear chemistry and nuclear physics at research reactor.* 101p. Order Number DE90513872. Source: NTIS (US Sales Only), PC A06/MF A01.

Significant nuclear Polarization has been obtained by optical pumping in solids. Specifically the detection of optical pumping in solids via the anisotoropy of nuclear radiation and the measurement of magnetic resonance with applied radio-frequency have been found to be a quite sensitive method for the spectroscopic study of unstable nuclei. We proposed to the CERN/ISOLDE to apply the method for mass separated and implanted p-shell atoms in solids. As first test candidates ^{75}Br and ^{114m}In are implanted into a GaAs and a AlGaInP crystals. After implantation, the samples are sent back to RIKEN and Osaka, Japan and the daughter nucleus ^{75}Se and the γ-decay products ^{114}In are off-line polarized with laser optical pumping and the hyperfine coupling constants in solids and also magnetic moments are measured with radiation detected magnetic resonance. In addition to get more accurate data of the previously known magnetic moments of these nuclei, we hope this test experiment may open the way to determine unambiguously the nuclear spins and the magnetic moments of the so-called spin-gap isomers in ^{211}Po and ^{212}Po isotopes which have been long-standing open problems related to shell model predictions. (author).

54217 (LA–11925-T) **Interaction of relativistic H$^-$ ions with thin foils.** Mohagheghi, A.H. Los Alamos National Lab., NM (USA). Sep 1990. 206p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-36. Order Number DE91000514. Source: NTIS, PC A10/MF A01; OSTI; INIS; GPO Dep.

Thesis submitted to Univ. of New Mexico, Albuquerque.

The response of relativistic H$^-$ ions to thin carbon foils was investigated for beam energies ranging from 226 MeV to 800 MeV. For the foil thicknesses we have studied, ranging from 15 to 300 μg/cm^2, an appreciable fraction of the H$^-$ beam survives intact, some H$^-$ ions are stripped down to protons, and the remainder is distributed over the states of H^0. This experiment is different from the low energy studies in that the projectile velocity is comparable to the speed of light, leading to an interaction time of typically less than a femtosecond. The present results challenge the theoretical understanding of the interaction mechanisms. An electron spectrometer was used to selectively field-ionize the Rydberg states, $9 < n < 17$, at beam energies of 581 MeV and 800 MeV. The yield of low-lying states were measured by Doppler tuning a Nd:YAG laser to excite transitions to a Rydberg state which was then field-ionized and detected. A simple model is developed to fit the yield of each state as a function of foil thickness. The simple model is successful in predicting the general features of the yield data. However, the data are suggestive of a more complex structure in the yield curves. The yield of a given state depends strongly on the foil thickness, demonstrating that the excited states are formed during the passage of the ions through a foil. The optimum thickness to produce a given state increases with the principal quantum number of the state suggesting an excitation process which is at least pratially stepwise. The results of a Monte Carlo simulation are compared with the experimental data to estimate the distribution of the excited states coming out of a foil. The distributions of the excited states and their dependence on foil thickness are discussed.

54218 (LA-UR–90-2950) **Dynamics of the Anderson model for dilute magnetic alloys: A quantum Monte Carlo and maximum entropy study.** Silver, R.N. (Los Alamos National Lab., NM (USA)); Gubernatis, J.E.; Sivia, D.S.; Jarrell, M. Los Alamos National Lab., NM (USA). [1990]. 15p. Sponsored by U.S. DOE Office of Administration and Human Resource Management. DOE Contract W-7405-ENG-36. (CONF-9006273–2: 14. workshop on condensed matter theories, Elba (Italy), 18-23 Jun 1990). Order Number DE91000445. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

In this article we describe the results of a new method for calculating the dynamical properties of the Anderson model. QMC generates data about the Matsubara Green's functions in imaginary time. To obtain dynamical properties, one must analytically continue these data to real time. This is an extremely ill-posed inverse problem similar to the inversion of a Laplace transform from incomplete and noisy data. Our method is a general one, applicable to the calculation of dynamical properties from a wide variety of quantum simulations. We use Bayesian methods of statistical inference to determine the dynamical properties based on both the QMC data and any prior information we may have such as sum rules, symmetry, high frequency limits, etc. This provides a natural means of combining perturbation theory and numerical simulations in order to understand dynamical many-body problems. Specifically we use the well-established maximum entropy (ME) method for image reconstruction. We obtain the spectral density and transport coefficients over the entire range of model parameters accessible by QMC, with data having much larger statistical error than required by other proposed analytic continuation methods.

54219 (LA-UR–90-2982) **Coherent Raman scattering in high-pressure/high-temperature fluids: An overview.** Schmidt, S.C.; Moore, D.S. Los Alamos National Lab., NM (USA). [1990].

28p. Sponsored by U.S. DOE Office of Administration and Human Resource Management. DOE Contract W-7405-ENG-36. (CONF-9009260--1: International symposium on coherent Raman spectroscopy, Samarkand (USSR), 18-20 Sep 1990). Order Number DE91000438. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The present understanding of high-pressure/high-temperature dense-fluid behavior is derived almost exclusively from hydrodynamic and thermodynamic measurements. Such results average over the microscopic aspects of the materials and are, therefore, insufficient for a complete understanding of fluid behavior. At the present, dense-fluid models can be verified only to the extend that they agree with the macroscopic measurements. Recently, using stimulated Raman scattering, Raman induced Kerr effect scattering, and coherent anti-Stokes Raman scattering, we have been able to probe some of the microscopic phenomenology of these dense fluids. In this paper, we discuss primarily the use of CARS in conjunction with a two-stage light-gas gun to obtain vibrational spectra of shock-compressed liquid N_2, O_2, CO, their mixtures, CH_3NO_2, and N_2O. These experimental spectra are compared to synthetic spectra calculated using a semiclassical model for CARS intensities and best fit vibrational frequencies, peak Raman susceptibilities, and Raman linewidths. For O_2, the possibility of resonance enhancement from collision-induced absorption is addressed. Shifts in the vibrational frequencies reflect the influence of increased density and temperature on the intramolecular motion. The derived parameters suggest thermal equilibrium of the vibrational levels is established less than a few nanoseconds after shock passage. Vibrational temperatures are obtained that agree with those derived from equation-of-state calculations. Measured linewidths suggest that vibrational dephasing times have decreased to subpicosecond values at the highest shock pressures.

54220 (ORNL/FTR–3772) **[Tenth International conference on conduction and breakdown in dielectric liquids]: Foreign trip report, September 8, 1990–September 16, 1990.** Christophorou, L.G. Oak Ridge National Lab., TN (USA). 5 Oct 1990. 6p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE91001151. Source: NTIS, PC A01/MF A01 - OSTI; GPO Dep.

The traveler attended the 10th International Conference on Conduction and Breakdown in dielectric Liquids held in Grenoble, France, September 10–14, 1990. He chaired the opening session of the conference, presented one paper, co-authored a second paper presented at the meeting, participated in the discussions during the formal sessions, and had informal discussions with many of the participants.

54221 (SAND–90-2440C) **The role of chemical interactions in ion-solid processes.** Dodson, B.W. Sandia National Labs., Albuquerque, NM (USA). [1990]. 22p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-900936–11: 7. international conference on ion beam modification of materials, Knoxville, TN (USA), 9-14 Sep 1990). Order Number DE91000763. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Computer simulation of low-energy ion-solid processes has greatly broadened in scope in recent years. In particular, realistic descriptions of the ion-solid and solid-solid interactions can now be utilized. The molecular dynamics technique, in which the equations of motion of the interacting atoms are numerically integrated, can now be used to characterize ion-solid interactions in a range of model material systems. Despite practical limitations of this procedure, a number of substantial results have appeared. The available results are examined to investigate the qualitative influence that chemical interactions have on low-energy ion-solid processes. 26 refs., 4 figs.

54222 (SAND–90-2549C) **Application of parallel computing to the Monte Carlo simulation of electron scattering in solids: A rapid method for profile deconvolution.** Romig, A.D. Jr. (Sandia National Labs., Albuquerque, NM (USA)); Plimpton, S.J.; Michael, J.R.; Myklebust, R.L.; Newbury, D.E. Sandia National Labs., Albuquerque, NM (USA). [1990]. 19p. Sponsored by U.S. DOE Defense Programs; U.S. DOE Energy Research. DOE Contract AC04-76DP00789. (CONF-900877–9: 12. international congress for electron microscopy, Seattle, WA (USA), 12-18 Aug 1990). Order Number DE91001227. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

X-ray microanalysis by analytical electron microscopy (AEM) has proven to be a powerful tool for characterizing the spatial distribution of solute elements in materials. True compositional variations over spatial scales smaller than the actual resolution for microanalysis can be determined if the measured composition profile is deconvoluted. Explicit deconvolutions of such data, via conventional techniques such as Fourier transforms, are not possible due to statistical noise in AEM microanalytical data. Hence, the method of choice is to accomplish the deconvolution via iterative convolutions. In this method, a function describing the assumed true composition profile, calculated by physically permissible thermodynamic and kinetic modeling, is convoluted with the x-ray generation function and the result compared to the measured composition profile. If the measured and calculated profiles agree within experimental error, it is assumed that the true compositional profile has been determined. If the measured and calculated composition profiles are in disagreement, the assumptions in the physical model are adjusted and the convolution process repeated. To employ this procedure it is necessary to calculate the x-ray generation function explicitly. While a variety of procedures are available for calculating this function, the most accurate procedure is to use Monte Carlo modeling of electron scattering.

54223 (SAND–90-2551C) **Silicon nitride formation from a silane-nitrogen ECR [electron cyclotron resonance] plasma.** Barbour, J.C. (Sandia National Labs., Albuquerque, NM (USA)); Stein, H.J.; Popov, O.A.; Yoder, M.; Outten, C.A. Sandia National Labs., Albuquerque, NM (USA). [1990]. 18p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-901035–5: 37. national American Vacuum Society symposium, Toronto (Canada), 8-12 Oct 1990). Order Number DE91001265. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Good quality, low temperature silicon nitride and oxynitride films were deposited downstream from an electron cyclotron resonance (ECR) plasma source using SiH_4 and N_2 gas mixtures. The Si/N ratio and H content in the deposited films were determined using Rutherford backscattering spectrometry (RBS)and elastic recoil detection (ERD). The H concentration was minimum for films with compositions closest to that of stoichiometric Si_3N_4. The optimum conditions for producing a stoichiometric Si_3N_4were: a SiH_4/N_2 flow ratio between 0.1 and 0.2, and an electrically isolated sample far from the ECR source. Infrared absorption spectra showed that as the film composition changed from N rich to Si rich the dominant bonds associated with H changed from N-H to Si-H. The addition of O_2 to the background gas formed an oxynitride with a low H content similar to the stoichiometric Si_3N_4 10 refs., 4 figs., 2 tabs.

54224 (UCRL-CR–104962) **Note on sufficient symmetry conditions for isotropy of the elastic moduli tensor.** Dresselhaus, M.S. (Massachusetts Inst. of Tech., Cambridge, MA (USA)); Dresselhaus, G. Lawrence Livermore National Lab., CA (USA); Massachusetts Inst. of Tech., Cambridge, MA (USA). 29 Aug 1990. 14p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. Order Number DE91000951. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Group theoretical methods are used to obtain the form of the elastic moduli matrices and the number of independent parameters for various symmetries. Particular attention is given to symmetry groups for which 3D and 2D isotropy is found for the stress-strain tensor relation. The number of independent parameters is given by the number of times the fully symmetric representation is contained in the direct product of the irreducible representations for two symmetrical second rank tensors. The basis functions for the lower symmetry groups are found from the compatibility relations and are explicitly related to the elastic moduli. These types of symmetry arguments should be generally useful in treating the elastic properties of solids and composites.

54225 (UCRL-JC–104938) **Real-space multiple scattering theory calculations of LEED [low-energy electron diffraction] intensities for stepped surfaces.** Zhang, X.-G. (Lawrence Berkeley Lab., CA (USA)); Rous, P.J.; Van Hove, M.A.; MacLaren, J.M.; Gonis, A.; Somorjai, G.A. Lawrence Livermore National Lab., CA

(USA). 25 Jul 1990. 7p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48 ;AC03-76SF00098. (CONF-9007131–3: 3. international conference on the structure of surfaces, Milwaukee, WI (USA), 9-12 Jul 1990). Order Number DE91000810. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

We use a newly developed real-space multiple scattering theory (RS-MST) to calculate low-energy electron diffraction (LEED) intensities from stepped surfaces. In this calculation the electron wavefunctions are expanded in terms of an angular momentum basis, utilizing the property of removal invariance of systems with semi-infinite periodicity. This strongly reduces the dependence of the calculation on the interlayer spacing and thus opens up the possibility of treating more open surfaces. This includes in particular stepped surfaces, to which conventional methods cannot be applied. Applications of the formalism to various stepped surfaces are presented. In particular, the results for Cu(311) and (331) surfaces obtained from both the layer doubling and RS-MST methods are compared. In addition, numerical techniques which can improve the convergence as well as the speed of the RS-MST approach are discussed. 6 refs., 3 figs.

54226 (UnB-FIS–02/90) **Magnetic modes in superlattices.** Oliveira, F.A. Brasilia Univ., DF (Brazil). Dept. de Fisica. Apr 1990. 18p. Order Number DE91605067. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

A first discussion of reciprocal propagation of magnetic modes in a superlattice is presented. In the absence of an applied external magnetic field a superllatice made of alternate layers of the type antiferromagnetic-non-magnetic materials presents effects similar to those of phonons in a dielectric superlattice. (A.C.A.S.).

54227 **CO_2-laser-induced homoepitaxy of amorphous silicon films.** James, R.B. (Advanced Materials Research Div., Sandia National Lab., Livermore, CA (US)). pp. 1016-1019 of Lasers '89. Harris, D.G.; Shay, T.M. STS Press, McLean, VA (USA) (1990). pp. 1159 (CONF-891261–: Lasers '89: 12th international conference on lasers and applications, New Orleans, LA (USA), 3-8 Dec 1989).

The authors have demonstrated that CO_2 laser radiation can be used to recrystallize deposited amorphous silicon films into epitaxial layers. Normal furnace annealing of these amorphous silicon films leads to the formation of polycrystals, rather than a single-crystal, due to the presence of impurities and the native oxide at the amorphous/crystalline interface. Using CO_2 laser pulses, defect-free epilayers were formed with thickness greater than 15000 Å, which is much larger than the previous work reported with Nd:YAG and ruby lasers.

54228 **Comment on "Phase transition in a restricted solid-on-solid surface-growth model in 2+1 dimensions".** Yan, H. (Randall Laboratory of Physics, The University of Michigan, Ann Arbor, MI (USA)); Kessler, D.A. *Physical Review Letters (USA)*, 65(5): 661 (30 Jul 1990). DOE Contract FG02-85ER45189.

A Comment on the Letter by Amar and Family, Phys. Rev. Lett. 64, 543 (1990).

54229 **Trace maps of general substitutional sequences.** Kolar, M. (The Institute of Physical—Chemical Research (RIKEN), Wako-shi, Saitama 351-01 (Japan)); Nori, F. *Physical Review, B: Condensed Matter (USA)*, 42(1): 1062-1065 (1 Jul 1990). DOE Contract FG03-84ER45108.

It is shown that for arbitrary *n*, there exists a trace map for any *n*-letter substitutional sequence. Trace maps are explicitly obtained for the well-known circle and Rudin-Shapiro sequences which can be defined by means of substitution rules on three and four letters, respectively. The properties of the two trace maps and their consequences for various spectral properties are briefly discussed.

54230 **Surface, interface, and thin-film magnetism.** Falicov, L.M. (Department of Physics, University of California-Berkeley, Berkeley, CA (USA)); Pierce, D.T.; Bader, S.D. *Journal of Materials Research (USA)*, 5(6): 1299-1340 (Jun 1990).

A comprehensive review and state of the art in the field of surface, interface and thin-film magnetism is presented. New growth techniques which produce atomically engineered novel materials, special characterization techniques to measure magnetic properties of low-dimensional systems, and computational advances which allow large complex calculations have together stimulated the current activity in this field and open new opportunities for research. The current status and issues in the area of material growth techniques and physical properties, characterization methods, and theoretical methods and ideas are reviewed. A fundamental understanding of surface, interface and thin-film magnetism is of importance to many applications in magnetics technology, which is also surveyed. Questions of fundamental and technological interest that offer opportunities for exciting future research are identified.

54231 **Processes for forming exoergic structures with the use of a plasma and for producing dense refractory bodies of arbitrary shape therefrom.** Holt, J.B.; Kelly, M.D. To Dept. of Energy, Washington, DC (USA). USA Patent 4,933,241/A/. 12 Jun 1990. Filed date 17 Feb 1989. USA Patent patents application 7-311,795. Int. Cl. B32B 9/00. 6p. Source: Patent and Trademark Office, Box 9, Washington, DC 20232 (USA).

Plasma spraying methods of forming exoergic structures and coatings, as well as exoergic structures produced by such methods, are presented. The methods include the plasma spraying of reactive exoergic materials that are capable of sustaining a combustion synthesis reaction onto a flat substrate or into molds of arbitrary shape and igniting the plasma sprayed materials, either under an inert gas pressure or not, to form refractory materials of varying densities and of varying shapes.

6561 Superconductivity

Refer also to citation(s) 53199, 53252, 53262, 53269, 53274, 53275, 53279, 53450, 53465, 54049, 54379

54232 (CNIC–00277) **Superconductivity and anisotropy of Y-Ba-Cu-O films made with an ohmic heating co-evaporation technique.** Cao Xiaowen (Academia Sinica, Hefei, AH (China). Inst. of Plasma Physics); Wen Haihu; Zhang Fengying. China Nuclear Information Centre, Beijing, BJ (China). 1988. 7p. (In English, Chinese). (ASIPP–0007). Order Number DE91605313. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

A superconducing film has been made with ohmic heating co-evaporation technique. The preliminary results are as follows: the onset temperature of superconducing transition is 96K, the zero resistance temperature is 78.6 K, and the width of the transition is 12 K (10% to 90% of normal resistance). Various physical parameters including the room temperature resisitance and superconducting T_c show that the sample is anisotropic. The measurement of R(T) also shows that there is a minimum resistance above T_c, which probably relates to localization of electrons and removal of oxygen atoms.

54233 (CNIC–00281) **Study of the double integration method for AC loss measurement in superconductor.** Tang Benzheng (Southwest Inst. of Physics, Leshan, SC (China)); He Xinghua; Liu Zhaoquan. China Nuclear Information Centre, Beijing, BJ (China). 1988. 7p. (In Chinese). (SIP–0030). Order Number DE91605314. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

The principle and device of the double integration mehtod for AC (alternating current) loss measurement in superconductor are described. The measuring results of three samples were given. The results were compared with the measuring value by the other method and calculating value, they agreed with them essentially.

54234 (CNIC–00313) **The investigation of high T_c superconductor Y-Ba-Cu-O by nuclear technology.** Liu Rongchuan (Nanjing Univ., JS (China). Dept. of Physics); Teng Minkang; Wang Guanghou; Shen Dexun; Xia Yuanfu. China Nuclear Information Centre, Beijing, BJ (China). Apr 1989. 15p. (In Chinese). (NU–0005). Order Number DE91605315. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

Structure and superconductivity of $YBa_2(Cu_{1-x}Fe_x)_3O_7$, and the influence of Fe-substitution on the high T_c superconductivity were investigated by Moessbauer spectroscopy and X-ray diffraction. Some abnormal behaviors of positron annihilation in the ceramic superconductor Y-Ba-Cu-O in the transition temperature region were found and the radiation effects of electrons and protons on this ceramic superconductor were studied.

54235 (CONF-900990–1) **Orientation-dependent critical currents in $Y_1Ba_2Cu_3O_{7-x}$ epitaxial thin films: Evidence for intrinsic flux pinning?.** Christen, D.K. (Oak Ridge National Lab., TN (USA)); Klabunde, C.E.; Feenstra, R.; Lowndes, D.H.; Norton, D.P.; Budai, J.D.; Kerchner, H.R.; Thompson, J.R.; Zhu, S.; Marwick, A.D. Oak Ridge National Lab., TN (USA). [1990]. 7p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From 4. annual conference on superconductivity and applications; Buffalo, NY (USA); 18-20 Sep 1990. Order Number DE91001518. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

For YBCO epitaxial thin films the basal plane transport critical current density J_c, flowing perpendicular to an applied magnetic field H, depends sensitively on the orientation of the crystal with respect to H. In particular, J_c is sharply peaked and greatly enhanced when H is precisely parallel to the copper-oxygen planes. Experiments on a series of epitaxial monolithic and superconductor-insulator multilayer thin films provide clear evidence that the enhancement is a bulk, rather than surface or thin sample, phenomenon. Measurements of the orientation dependence are presented and compared with a model of "intrinsic flux pinning" by the layered crystal structure.

54236 (IC–90/121) **Predicted fare infrared transparency of $Bi_2Sr_2CaCu_2O_8$ as a tool for investigation of the superconducting gap.** Mishonov, T.M. International Centre for Theoretical Physics, Trieste (Italy). Jun 1990. 5p. Order Number DE91605316. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

It is shown, that for electric fields polarized perpendicular to the conducting CuO planes (in c-direction) the plasma frequency $\omega_c \simeq$ 1 meV is considerably lower than the superconducting gap $2\Delta(0)$ at low temperatures. This is caused by the giant mass of the Cooper pairs moving in the c-direction. In frequency window ω_c-$2\Delta(0)$ the $Bi_2Sr_2CaCu_2O_8$(2212) crystal is transparent for the electromagnetic (e.m.) waves propagating parallel to the conducting CuO planes (a - b planes). Experimentally ω_c can be determined by investigation of reflection coefficient R for the a - c surface of thick single-crystal. Investigating the FIR transparency of 2212 can give a new method for determination of superconducting gap Δ insensitive to the quality of the sample surface. (author). 9 refs.

54237 (IC–90/122) **Magnetoplasma waves in thin high temperature superconducting layers.** Mishonov, T.M. International Centre for Theoretical Physics, Trieste (Italy). Jun 1990. 5p. Order Number DE91605317. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

It is shown that in thin $Bi_2Sr_2CaCu_2O_8$ layers with thickness d much lower than the London penetration depth λ two dimensional magnetoplasma waves can propagate. These collective excitations are analogous to the well known excitations of two dimensional electron gas. The propagation of these plasma waves is possible in both normal and superconducting phases if their frequency ω is lower than the superconducting gap $2\Delta(0)$ at zero temperature. In the case of the magnetic field H perpendicular to the layer the plasma frequency receives a shift connected with the cyclotron frequency. Magnetoplasma wave frequency shift like that is possible for a superconducting phase only in the flux flow regime for very large wave amplitudes. Measurement of the magnetoplasma shift created by the hybridisation between plasma and cyclotron waves will give a new direct method for determining both the cyclotron mass of the holes m_h in the normal phase and the cyclotron mass of the Cooper pairs m^* in the superconducting phase. The checking of the BCS clean limit relation $m^*=2m_h$ can be an important tool for understanding of the mechanism of high temperature superconductivity. (author). 15 refs.

54238 **The effect of temperature and oxygen partial pressure on the stoichiometry of Y-Ba-Cu-O thin films.** Razavi, A. (School of Engineering and Physical Sciences, Wilkes College, Wilkes-Barre, Pennsylvania 18766 (USA)); Bonk, R.; Brewer, J.H.; Warrington, D.; Yuhas, D. *AIP Conference Proceedings (American Institute of Physics) (USA)*, 199(1): 109-113 (25 Jan 1990). (CONF-891092–: 3. annual topical conference on high $T_c$superconducting thin films: processing, characterization, and applications, Boston, MA (USA), 23-27 Oct 1989).

Thin films of 1-2-3 high T_c superconductors were fabricated by RF magnetron sputtering from a several compound oxide target. Film composition was studied as a function of oxygen content of the target, power density, temperature, and pressure. Compositional analysis was performed by Rutherford backscattering spectroscopy and energy dispersive x-ray analysis before and after annealing treatment. The resulting film compositions were then related to the aforementioned sputtering parameters so that optimal sputtering conditions for achieving consistent 1-2-3 film stoichiometry could be established.

54239 **Magnus forces and statistics in 2 + 1 dimensions.** Davis, R.L. (Institute for Advanced Study, Princeton, NJ (USA)). *Modern Physics Letters A (USA)*, 5(11): 853-862 (10 May 1990).

Spinning vortex solutions to the abelian Higgs model, not Nielsen-Olesen solutions, are appropriate to a Ginzburg-Landau description of superconductivity. The main physical distinction is that spinning vortices experience the Magnus force while Nielsen-Olesen vortices do not. In 2 + 1 dimensional superconductivity without a Chern-Simons interaction, the effect of the Magnus force is equivalent to that of a background fictitious magnetic field. Moreover, the phase obtained an interchanging two quasi-particles is always path-dependent. When a Chern-Simons term is added there is an additional localized Magnus flux at the vortex. For point-like vortices, the Chern-Simons interaction can be seen as defining their intrinsic statistics, but in realistic cases of vortices with finite size in strong Magnus fields the quasi-particle statistics are not well-defined.

54240 **Spinning vortices in type 2 superconductors.** Davis, R.L. (Institute for Advanced Study, Princeton, NJ (USA)). *Modern Physics Letters A (USA)*, 5(12): 955-963 (20 May 1990).

A field-theoretical model displaying macroscopic type 2 superconductivity involves electromagnetic and antisymmetric tensor gauge fields interacting in a special background. Vortex lines are represented by Kalb-Ramond strings, and the force law for a vortex in a supercurrent follows naturally. It is shown by a duality transformation that this theory is equivalent to the low-energy sector of a spontaneously broken abelian Higgs model, but the existence of a charged background changes the nature of the symmetry breaking. As a result, it is not Neilsen-Olesen solutions but rather the spinning vortices which describe the macro-scopic properties of flux tubes in a superconductor. The relationship with Ginzburg-Landau theory is briefly discussed.

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Refer also to citation(s) 53337, 53338, 53365, 53462, 53463, 53476, 53477, 53887, 54035, 54037, 54038, 54054, 54056, 54058, 54059, 54060, 54061, 54062, 54063, 54064, 54065, 54066, 54224, 54419

54241 (CBPF-NF–003/90) **New symmetries for the Dirac equation.** Linhares, C.A.; Mignaco, J.A. Centro Brasileiro de Pesquisas Fisicas (CBPF), Rio de Janeiro, RJ (Brazil). 1990. 19p. Order Number DE91604898. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

The Dirac equation in four dimension is studied describing fermions, both as 4 x 4 matrices and differential forms. It is discussed in both formalisms its properties under transformations of the group SU(4). (A.C.A.S.).

54242 (CBPF-NF–022/89) **A new short range gravitational force in the leptonic world.** Novello, M. (Centro Brasileiro de Pesquisas Fisicas (CBPF), Rio de Janeiro, RJ (Brazil)); Elbaz, E. Centro Brasileiro de Pesquisas Fisicas (CBPF), Rio de Janeiro, RJ (Brazil). 1989. 20p. Order Number DE91604921. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

Grishchuk's approach is used to introduce Gravitation via a rank-two symmetric tensor field in a flat space-time. The consequences of a non-identical coupling of gravity with electrons and neutrinos is examined. The local counter part of the gravitational interaction must occur mediated by massive spin-two tensor bosons. A universal Higgs mechanism thus determine the mass of these bosons. (A.C.A.S.).

54243 (CNIC-I-004, pp. 9) **Non-relativistic BUU equation.** Ge Lingxiao; Zhuo Yizhong. China Nuclear Information Centre, Beijing, BJ (China); Academia Sinica, Lanzhou, GS (China). Inst. of Modern Physics. Jun 1990. In *IMP annual report, 1988 (January-December)*. 138p. Order Number DE91606195. Source: NTIS (US Sales Only), PC A07/MF A01; OSTI; INIS.

Published in summary form only. BOLTZMANN EQUATION/ion collisions; BOLTZMANN EQUATION/many-body problem; BORN APPROXIMATION; DYSON REPRESENTATION; GREEN FUNCTION; HARTREE-FOCK METHOD; HEAVY IONS; LOCALITY; MEAN-FIELD THEORY; QUANTUM FIELD THEORY

54244 (IC-90/42) **Modulation on electromagnetic waves in a circular waveguide by gravitational waves.** Tang Mengxi (International Centre for Theoretical Physics, Trieste (Italy)); Li Fangyu. International Centre for Theoretical Physics, Trieste (Italy). Apr 1990. 13p. Order Number DE91604922. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

The modulation on electromagnetic waves with angle frequency ω_e, travelling around the circular waveguide by plane gravitational waves, with angle frequency ω_g, incident perpendicularly to the plane, where the waveguide is located, is discussed. It is shown that, in general, the energy flux density of electromagnetic waves would be added by three new components, with angle frequencies $(2\omega_e \pm \omega_g)$ and ω_g, respectively. For low-frequency gravitational waves, the relative amplitude modulation of energy flux density is smaller in order than h_0. For high-frequency gravitational waves, the modulation is the same as in order h_0. Specially, when between ω_g, ω_e and ω_0, the cyclical angle frequency of the electromagnetic waves travelling around the circular waveguide, $\omega_g = 2\omega_e >> \omega_0$ is satisfied, it emerges that the relative amplitude modulation of energy flux density would be greater in several orders than h_0. The result is not cancelled by small errors of these parameters. It is very important to detect very weak signals of gravitational waves. (author). 8 refs.

54245 (IC-90/73) **Spontaneous symmetry breaking in the gauge gravitation theory.** Sardanashvily, G.A. International Centre for Theoretical Physics, Trieste (Italy). Jun 1990. 22p. Order Number DE91604923. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

The specificity of spontaneous symmetry breaking in the gauge theory of gravity is that Dirac fermion fields possess only exact Lorentz symmetries. As a consequence, different tetrad gravitational fields h and h' define nonisomorphic representations of cotangent vectors to a space-time manifold X^4 by Dirac's γ-matrices on fermion fields. One needs these representations in order to construct the Dirac operator. Dirac fermion fields therefore must be considered only in a pair with a certain tetrad gravitational field. We describe the complex of such fermion-gravitational pairs by means of a spinor fibre bundle over the generalized coordinate space $X^4 \times (GL^+(4, R)/SO(3,1))$. We show that gravitational fields h fail to form an affine space modelled after any vector space of deviations h-h' of some background field h. They therefore fail to be quantized in accordance with the familiar quantum field theory. However, one can consider nongravitational deviations σ of h such that $h+\sigma$ is not a gravitational field. These deviations form a vector space, i.e. they satisfy the superposition principle. Their Lagrangian, however, differs from familiar Lagrangians of gravitation theory. For instance, it contains mass-like terms. (author). 19 refs.

54246 (IC-90/129) **A new class of infinite-dimensional Lie algebras: an analytical continuation of the arbitrary finite-dimensional semisimple Lie algebra.** Fradkin, E.S. (International Centre for Theoretical Physics, Trieste (Italy)); Linetsky, V.Ya. International Centre for Theoretical Physics, Trieste (Italy). Jun 1990. 13p. Order Number DE91604890. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

With any semisimple Lie algebra g we associate an infinite-dimensional Lie algebra AC(g) which is an analytic continuation of g from its root system to its root lattice. The manifest expressions for the structure constants of analytic continuations of the symplectic Lie algebras $sp2_n$ are obtained by Poisson-bracket realizations method and AC(g) for $g=sl_n$ and so_n are discussed. The representations, central extension, supersymmetric and higher spin generalizations are considered. The Virasoro theory is a particular case when $g=sp_2$. (author). 9 refs.

54247 (IC-90/134) **Path integral for relativistic particle theory.** Fradkin, E.S.; Gitman, D.M.; Shvartsman, Sh.M. International Centre for Theoretical Physics, Trieste (Italy). Jun 1990. 13p. Order Number DE91604900. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

An action for a relativistic spinning particle interacting with external electromagnetic field is considered in reparametrization and local supergauge invariant form. It is shown that various path integral representations derived for the causal Green function correspond to the different forms of the relativistic particle action. The analogy of the path integral derived with the Lagrangian path integral of the field theory is discussed. It is shown that to obtain the causal propagator, the integration over the null mode of the Lagrangian multiplier corresponding to the reparametrization invariance, has to be performed in the (0,+infinity) limits. (author). 23 refs.

54248 (IC-90/141) **Algebraic solution of an anisotropic nonquadratic potential.** Boschi Filho, H. (International Centre for Theoretical Physics, Trieste (Italy)); Vaidya, A.N. International Centre for Theoretical Physics, Trieste (Italy). Jun 1990. 13p. Order Number DE91604901. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

We show that an anisotropic nonquadratic potential, for which a path integral treatment had been recently discussed in the literature, possesses the $(SO(2,1)xSO(2,1))\Lambda SO(2,1)$ dynamical symmetry and constructs its Green function algebraically. A particular case which generates new eigenvalues and eigenfunctions is also discussed. (author). 11 refs.

54249 (IC-90/144) **Exact solutions of spin (Rabi) precession, transmission and reflection in the Eckhart potential.** Barut, A.O. (International Centre for Theoretical Physics, Trieste (Italy)); Beker, H. International Centre for Theoretical Physics, Trieste (Italy). Jun 1990. 8p. Order Number DE91604902. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

The bell shaped Eckhart potential allows one to discuss the passage of neutrons, atoms, and other particles through various fields in a continuous manner. Here the exact formulas for the spin (or Rabi) precession, and for the coefficients of reflection and transmission are derived. (author). 5 refs.

54250 (IC-90/145) **Quaternionic six-dimensional (super)twistor formalism and composite (super)spaces.** Lukierski, J. (International Centre for Theoretical Physics, Trieste (Italy)); Nowicki, A. International Centre for Theoretical Physics, Trieste (Italy). Jun 1990. 11p. Order Number DE91604891. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

We extend by real quaternions the D=4 twistor and supertwistor formalism. The notion of quaternionic D=4 composite superspaces is considered. It is shown how to construct D=6 real composite space-time variables as well as D=6 real composite superspaces. (author). 21 refs.

54251 (IC-90/164) **Phase transitions induced by the Aharonov-Bohm field.** Krive, I.V. (International Centre for Theoretical Physics, Trieste (Italy)); Naftulin, S.A. International Centre for Theoretical Physics, Trieste (Italy). Jul 1990. 19p. Order Number DE91604892. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

The influence of the Aharonov-Bohm flux (ϕ) on the order parameters of the 3-dimensional Gross-Neveu model and CP^N-model in R^2xS^1 space is considered. It is shown that the variation of flux causes the order parameter oscillations and for the small enough length of circular coordinate $l < l_c$ these oscillations attended with re-ordering phase transitions (i.e. the repeating transitions between the ordered and the disordered phases of the models in question). (author). 22 refs, 3 figs.

54252 (IC-90/188) **Classical and quantum mechanics of the relativistic particle.** Gitman, D.M. (International Centre for Theoretical Physics, Trieste (Italy)); Tyutin, I.V. International Centre

for Theoretical Physics, Trieste (Italy). Jul 1990. 29p. Order Number DE91604903. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

It is shown that the standard actions of the relativistic point-like particle are adapted within the corresponding interpretation to describe particle and antiparticle at the same time. Special gauge in which this possibility realize naturally both in classical and in quantum theory is pointed out. A consistent procedure of canonical quantization of relativistic point-like particle without and with spin is considered. the operator formulation of the system in question is manifestly constructed. So built quantum mechanics proves to be equivalent for a spinless particle to Klein-Gordon theory and for spinning particle to Dirac theory. (author). 14 refs.

54253 (IFT-P–12/89) **Supersymmetric quantum mechanics and higher excited states of a non-polynomial potential.** Drigo Filho, E. (Instituto de Fisica Teorica (IFT), Sao Paulo, SP (Brazil)); Ricotta, R.M. Instituto de Fisica Teorica (IFT), Sao Paulo, SP (Brazil). Mar 1989. 3p. Source: Available from the Library of the Comissao Nacional de Energia Nuclear, RJ, Brazil.

Supersymmetric quantum mechanics is used to evaluate new excited states of a non-polynomial potential. This illustrates a method of evaluating higher excited states of quantum mechanical potentials. (A.C.A.S.).

54254 (IFUSP-P–819) **Einstein-Ehrenfest's radiation theory and Compton-Debye's kinetics.** Barranco, A.V. (Imperial Coll. of Science and Technology, London (UK). Optics Section); Franca, H.M. Sao Paulo Univ., SP (Brazil). Inst. de Fisica. Jan 1990. 32p. Order Number DE91604905. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

Einstein and Ehrenfest's radiation theory is modified in order to introduce the efeects of random zero-point fields, characteristics of classical stochastic electrodynamics. As a result, the Compton and Debye's kinematic relations are obtained within the realm of a completely undulatory theory, that is, without having to consider the corpuscular character of the photon. (A.C.A.S.).

54255 (IFUSP-P–831) **Deformed GOE for systems with a few degrees of freedom in the chaotic regime.** Hussein, M.S.; Pato, M.P. Sao Paulo Univ., SP (Brazil). Inst. de Fisica. Mar 1990. 15p. Order Number DE91604906. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

New distribution laws for the energy level spacings and the eigenvector amplitudes, appropriate for systems with a few degrees of freedom in the chaotic regime, are derived by conveniently deforming the GOE. The cases of 2x2 and 3x3 matrices are fully worked out. Suggestions concerning the general case of matrices with large dimensions are made. (author).

54256 (LA-UR–90-3328) **State space forecasting and noise reduction.** Eubank, S.; Casdagli, M.; Farmer, J.D.; Gibson, J. Los Alamos National Lab., NM (USA). [1990]. 3p. Sponsored by U.S. DOE Office of Administration and Human Resource Management. DOE Contract W-7405-ENG-36. (CONF-901209–4: 29. IEEE conference on decision and control, Honolulu, HI (USA), 5-7 Dec 1990). Order Number DE91000184. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

We discuss the effects of nonlinearity and noise on the problem of finding states and dynamics. We point out problems which arise in the construction of state space models for scalar time series. We describe solutions for the case when error due to noise dominates parameter estimation error and outline a framework for the general case.

54257 (SAND–90-2091) **The inclusion of wall loss in electromagnetic finite-difference time-domain thin-slot algorithms.** Riley, D.J.; Turner, C.D. Sandia National Labs., Albuquerque, NM (USA). Sep 1990. 46p. Sponsored by U.S. DOE Environment Health & Safety. DOE Contract AC04-76DP00789. Order Number DE91001046. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Sub-gridding techniques enable finite-difference time-domain (FDTD) electromagnetic codes to model apertures that are much narrower than the spatial resolution of the FDTD mesh. Previous thin-slot methods have assumed that the slot walls are perfectly conducting. As the slot depth-to-width ratio becomes large, interior wall losses for realistic materials can significantly affect the coupling through the slot, and therefore these loss effects should not be neglected. This paper presents two methods for incorporating loss for walls with good, but not perfect conductivity, into the FDTD calculations. The first method modifies an FDTD equation internal to the slot to include a surface-impedance contribution. This method is appropriate for the usual FDTD thin-slot formalisms. The second method includes the losses into a "half-space" integral equation that can be used by the recently introduced Hybrid Thin-Slot Algorithm. Results based on the two methods are compared for a variety of slot parameters and wall conductivities.

54258 (UFPB-DF–01/90) **Distribution of quantum states in enclosures of finite size II.** Souto, J.H.; Chaba, A.N. Paraiba Univ., Joao Pessoa, PB (Brazil). Dept. de Fisica. 1990. 42p. Order Number DE91604909. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

By using the modified form of Poisson's summation formula the expression for the number of eigenstates of a particle in spherical and cylindrical enclosures is calculated. (A.C.A.S.).

54259 (UFPB-DF–02/90) **Harmonic oscillator with time - dependent mass and frequency.** Dantas, C.M.A.; Pedrosa, I.A.; Baseia, B. Paraiba Univ., Joao Pessoa, PB (Brazil). Dept. de Fisica. 1990. 21p. Order Number DE91604910. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

A general treatment of the quantal harmonic oscillator with time-dependent mass and frequency is presented. The treatment is based on the use of some time-dependent transformations in the method of invariants of Lewis and Riesenfeld. Exact coherent states for such a system are also constructed. (A.C.A.S.).

54260 (UFPB-DF–05/89) **Distribution of quantum states in enclosures of finite size I.** Souto, J.H.; Chaba, A.N. Paraiba Univ., Joao Pessoa, PB (Brazil). Dept. de Fisica. 1989. 28p. Order Number DE91604911. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

The expression for the density of states of a particle in a three-dimensional rectangular box of finite size can be obtained directly by Poissons's Summation formula. The expression for the case of an enclosure in the form of an infinite rectangular slab is derived. (A.C.A.S.).

54261 Geometric characterization of states in two-dimensional quantum gravity. Agishtein, M.E. (Program in Applied and Computational Mathematics, Princeton Univ., Fine Hall, Princeton, NJ (US)); Jacobs, L.; Migdal, A.A.; Richardson, J.L. *Modern Physics Letters A (USA),* 5(12): 965-677 (20 May 1990).

The authors report first results of a large-scale simulation of two-dimensional quantum gravity using the dynamical triangulation model for systems of up to sixteen thousand triangles. Their results for the internal geometry show an unexpectedly complicated behavior of the internal volume as function of the internal radius. A simple fractal characterization is inadequate to describe the geometry of the states in the system.

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7001 Plasma Research

Refer also to citation(s) 53137, 53323, 53458, 53459, 53460, 53463, 53464, 53545, 53948, 53952, 53954, 53955, 53967, 54348, 54356, 54370, 54382, 54385, 54388, 54389, 54393

54262 (CBPF-NF–006/90) **Search for the Quark-Gluon plasma in heavy ion reactions.** Kodama, T. Centro Brasileiro de Pesquisas Fisicas (CBPF), Rio de Janeiro, RJ (Brazil). 1990. 28p. (In Portuguese). Order Number DE91605138. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

This paper presents a brief review of the recent results of the analysis and experiments with ultrarelativistic heavy ion reactions. (A.C.A.S.).

54263 (CEA-CONF–10114) **Large infrared light polari-interferometer for JET.** Veron, D. (CEA Centre d'Etudes de

Limeil, 94 - Villeneuve-Saint-Georges (FR)); Braithwaite, G.; Gottardi, N.; Magyar, G.; O'Rourke, J.; Ryan, J. CEA Centre d'Etudes de Limeil, 94 - Villeneuve-Saint-Georges (France). 1989. 6p. (CONF-8911248–: 4. Symposium on Lasers Aids Plasmas Diagnostics, Fukuoka (Japan), 20-23 Nov 1989). Order Number DE91716288. Source: NTIS (US Sales Only), PC A02/MF A01.

The multichannel polari-interferometer installed on JET is feeded by the 195μm radiation of a DCN laser. It has been operated for several years with 98% availability and a reduced maintenance.

54264 (CNIC–00304) **Investigation of sawtooth behavior and confinement property with RHF on the HT-6B tokamak.** Hao Yuping (Academia Sinica, Hefei, AH (China). Inst. of Plasma Physics); Xie Jikang; Li Linzhong. China Nuclear Information Centre, Beijing, BJ (China). Jan 1989. 10p. (In Chinese, English). (ASIPP–0009). Order Number DE91605133. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

The experiment results of the resonant helical field (RHF) effects on plasma confinement and sawtooth behavior on the HT-6B Tokamak are presented. The RHF makes decrease of electron thermal conductivity, broadening of temperature profile, increase of plasma density and enhancement of impurity radiation, in meanwhile intensification of sawtooth oscillation (in amplitude, period, rising slope and invert radius) and suppression of m = 2, 3, 4 modes. It is shown that the discharge transforms to a new discharge condition.

54265 (CNIC–00305) **Experiment of laser thomson scattering at HL-1 tokamak device.** Zuo Henian (Southwest Inst. of Physics, Leshan, SC (China)); Chen Jiafu; Yan Derong; Liu Aiping; Shi Peilan; Wang Wei; Liu Xiaomei. China Nuclear Information Centre, Beijing, BJ (China). May 1989. 6p. (In Chinese). (SIP–0034). Order Number DE91605134. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

The structure and performance of the Ruby Laser Thomson Scattering apparatus for HL-1 tokamak device is described. The method of acquisition and calibration of multichannel scattered signals are presented. Examples of measured electron temperature T. with experimental error are given.

54266 (CNIC–00310) **The experiment with super low density on HT-6M tokamak.** Fan Shuping (Academia Sinica, Hefei, AH (China). Inst. of Plasma Physics). China Nuclear Information Centre, Beijing, BJ (China). Mar 1989. 8p. (In English, Chinese). (ASIPP–0010). Order Number DE91605135. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

The HT-6M Tokamak can be operated stably in the super low density (SLD) region with a few over-hot electrons by some specific methods. The main parameters were: N-bar$_e$=(0.2 $\approx$ 0.6) x $10^{13}cm^{-3}$; I_p=60 $\approx$ 80 kA; V_1=0.7 $\approx$ 2.0 V; B=0.7 $\approx$ 1.0 T; α=18 cm; R=63 cm. In such discharges, the plasma density was determined entirely by the outgassing of the limiter and wall, and independent of the initial hydrogen pressure p_0 totally. The plasma was silently with very small sawteeth. The MHD instabilities (m=2, 3) only appeared in the current decay stage. It had a peaked T_e (γ) profile and a flat N_e(γ) profile. The energy confinement time (τ=1 $\approx$ 2 ms) was about 2 $\approx$ 4 times of the value calculated from the Alcator Scaling law.

54267 (CONF-901007–19) **ITER global stability limits.** Hogan, J.T.; Uckan, N.A. Oak Ridge National Lab., TN (USA). [1990]. 16p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From 9. topical meeting on technology of fusion energy; Oak Brook, IL (USA); 7-11 Oct 1990. Order Number DE91001488. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The MHD stability limits to the ITER operational space have been examined with the PEST ideal stability code. Constraints on ITER operation have been examined for the nominal operational scenarios and for possible design variants. Rather than rely on evaluation of a relatively small number of sample cases, the approach has been to construct an approximation to the overall operational space, and to compare this with the observed limits in high-β tokamaks. An extensive database with ~20,000 stability results has been compiled for use by the ITER design team. Results from these studies show that the design values of the Troyon factor (g $\sim$ 2.5 for ignition studies, and g $\sim$ 3 for the technology phase) which are based on present experiments, are also expected to be attainable for ITER conditions, for which the configuration and wall-stabilisation environment differ from those in present experiments. Strongly peaked pressure profiles lead to degraded high-β performance. Values of g $\sim$ 4 are found for higher safety factor ($q_\psi \leq 4$) than that of the present design ($q_\psi \sim 3$). Profiles with q(0) < 1 are shown to give g $\sim$ 2.5, if the current density profile provides optimum shear. The overall operational spaces are presented for g-q_ψ, q_ψ-l_i, q-α_p and l_i-q_ψ.

54268 (CTA-IEAv-RP–019/86) **Generalized conformal coordinates and profile studies with HBT.** Goedbloed, J.P. (FOM - Institut voor Plasma-fisica, Rijnhuizen (Netherlands)); Hogeweij, G.M.D.; Kleibergen, R.; Lassing, S.; Rem, J.; Galvao, R.M.O.; Sakanaka, P.H. Centro Tecnico Aeroespacial (CTA-IEAv), Sao Jose dos Campos, SP (Brazil). Inst. de Estudos Avancados. Jun 1986. 6p. Order Number DE91605136. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

Global and local stability of high-β tokamak plasmas with various currents and pressure profiles and with different cross-sections have been studied with the numerical program HBT. It is reported new extensions of these studied. (A.C.A.S.).

54269 (DOE/ER/53223–146) **Plasma properties: Annual progress report for 1990.** Weitzner, H. New York Univ., NY (USA). Courant Inst. of Mathematical Sciences. Aug 1990. 44p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-86ER53223. Order Number DE91001361. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The topics of active research in the calendar year 1989 included: RF induced plasma transport, not only for its effects on the mean particle distribution function but also as a means to enhance confinement of particles and to eliminate relatively cold alpha particle ash; thorough statistical analysis of tokamak data; improved neoclassical transport analysis; deeper analysis of two-fluid Braginskii transport in a tokamak; modelling of the plasma edge and wall interaction problem; reformulation of ballooning mode stability analysis in particularly strong and general terms; MHD modelling of tokamak phenomena, such as H-mode transition, and giant sawteeth, description of highly elongated tokamaks; and analysis of edge plasma RF antenna interactions. Our basic plasma physics studies include: statistical mechanics of Coulomb gases in bounded domains; theory of MHD instabilities with flow; numerical scheme for kinetic equations with nontrivial collision operators, and heat flow in particle simulations induced by discreteness effects. In addition, there is a modest space plasma physics effort funded by non-DOE sources. The studies of heating of the solar corona are strongly affected by work from the fusion program. Equally, work on ballooning modes led to work in magnetotail instabilities and additional solar corona heating mechanisms. We except to keep some research effort in this area. We do not include in this proposal plans for any new work in this field.

54270 (DOE/ER/53223–T3) **Advanced toroidal theory: Annual progress report for 1990.** Garabedian, P.R. New York Univ., NY (USA). Courant Inst. of Mathematical Sciences. Aug 1990. 17p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-86ER53223. Order Number DE91001371. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

This report discusses plasmas confinement and transport theory in toroidal shape magnetic confinement configurations. (LSP)

54271 (GA-A–20104) **DIII-D physics analysis database.** Bramson, G.; Schissel, D.P.; DeBoo, J.C.; St. John, H. General Atomics, San Diego, CA (USA). Oct 1990. 14p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-89ER51114. (CONF-900557–19: 8. topical conference on high-temperature plasma diagnostics, Hyannis, MA (USA), 6-10 May 1990). Order Number DE91001293. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Since June 1986 the DIII-D tokamak has had over 16000 discharges accumulating more than 250 Gigabytes of raw data (currently over 30 Mbytes per discharge). The centralized DIII-D databases and the associated support software described earlier provide the means to extract, analyze, store, and display reduced sets of data for specific physics issues. The confinement, stability,

transition, and cleanliness databases consist of more than 7500 records of basic reduced diagnostic data datasets. Each database record corresponds to a specific snapshot in time for a selected discharge. Recently some profile datasets have been implemented. Diagnostic data are fit by a cubic spline or a parabola by the in-house ENERGY code to provide density, temperature, radiated power, effective charge (Z_{eff}), and rotation velocity profiles. These fits are stored in the profile datasets which are inputs for the ONETWO code which computes transport data. 3 refs., 4 figs.

54272 (GA-A–20107) **Fast alpha diagnostics using carbon pellet injection.** Fisher, R.K.; McChesney, J.M.; Howald, A.M.; Parks, P.B.; Thomas, D.M.; McCool, S.C.; Roman, W.L. General Atomics, San Diego, CA (USA). Sep 1990. 14p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-89ER53277. (CONF-900557–18: 8. topical conference on high-temperature plasma diagnostics, Hyannis, MA (USA), 6-10 May 1990). Order Number DE91001105. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Charge exchange interactions of alpha particles with the ablation cloud surrounding an injected carbon pellet can be used to measure the energy spectrum of the incident fast confined alpha particles in a fusion plasma. Measurement of helium neutrals from $He^{2+} + C^{4+} \rightarrow He^{0} + C^{6+}$ interactions appears to be the most attractive option. This paper describes progress on developing this diagnostic including measurements during pellet injection into the TEXT tokamak. 14 refs., 2 figs.

54273 (GA-A–20108) **Magnetic pitch angle measurements on text using laser-enhanced attenuation of a Li beam.** West, W.P.; McChesney, J.; Thomas, M.K.; Yang, X.Z. General Atomics, San Diego, CA (USA). Sep 1990. 12p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-89ER53277. (CONF-900557–17: 8. topical conference on high-temperature plasma diagnostics, Hyannis, MA (USA), 6-10 May 1990). Order Number DE91001106. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The polarization of the π component of the Zeeman split Li2P-2S transition allows a direct spectroscopic measurement of the local magnetic pitch angle. Li atoms are injected radially into TEXT as a 95 keV beam, and the intensity of the transmitted beam is detected. A polarization-modulated, cavity-dumped dye laser, tuned into resonance with the π line, is injected collinearly with the beam. Laser excitation of the beam results in an enhanced beam attenuation. Time-resolved detection of the transmitted Li beam allows determination of the local magnetic pitch angle. Details of the system and results of recent measurements will be discussed. (3 refs.)

54274 (GA-A–20112) **Infrared thermography system on DIII-D.** Petrie, T.W. (General Atomics, San Diego, CA (USA)); Hill, D.N.; Baptista, J.; Brown, M. General Atomics, San Diego, CA (USA). Oct 1990. 16p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-89ER51114 ;W-7405-ENG-48. (CONF-900557–20: 8. topical conference on high-temperature plasma diagnostics, Hyannis, MA (USA), 6-10 May 1990). Order Number DE91001294. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Six infrared cameras measure temperature changes on the protective graphite armor inside the DIII-D vacuum vessel. Simultaneous time dependent temperature measurements are made on armor tiles located on the centerpost and divertor regions, and on both outboard limiters. The nearly-complete poloidal coverage is useful in measuring both the plasma heat flux distributions inside the vessel and the plasma power balance. Spatial resolution of each camera system is $\lesssim$1 cm, while the minimum resolvable time is 125 μsec. Data from the IR TV systems is recorded on video tape, and is post-processed serially, using an image processor with an AT-compatible microcomputer. The processing system controls all VCRs, interprets DIII-D timing pulses, digitizes video data in the pre-determined regions of interest, averages digitized signals to reduce noise, and constructs data files which are then stored as part of the permanent shot record.

54275 (GA-A–20113) **An edge density fluctuation diagnostic for DIII-D using lithium beams.** Thomas, D.M.; Hyatt, A.W.; Thomas, M.P. General Atomics, San Diego, CA (USA). Sep 1990. 15p. Sponsored by U.S. DOE Energy Research. DOE Contract FG03-90ER54081. (CONF-900557–21: 8. topical conference on high-temperature plasma diagnostics, Hyannis, MA (USA), 6-10 May 1990). Order Number DE91001326. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

In order to investigate fluctuations in the edge regions of tokamaks and their influence on particle and energy transport, we are developing an ñ diagnostic for DIII-D system based on an injected neutral lithium beam. Analysis of the 670.8 nm light emitted along the beam trajectory due to collisional excitation should yield the behavior of the electron density and its associated fluctuations in the edge region of DIII-D in both L- and H-mode plasma configurations. The planned system, design considerations, and expected performance levels will be presented. 22 refs., 2 figs.

54276 (GA-A–20181) **Recent results from DIII-D and their implications for next generation tokamaks.** Luxon, J.L.; Bramson, G.; Burrell, K.H.; Brooks, N.H.; Callis, R.W.; Carlstrom, T.N.; Chu, M.S.; Colleraine, A.P.; DeBoo, J.C.; Ferron, J.R.; Freeman, R.; Gohil, P.; Greenfield, C.M.; Groebner, R.J.; Hong, R.; Howl, W.; Hsieh, C.L.; Jackson, G.L.; Jensen,.General Atomics, San Diego, CA (USA). Jul 1990. 20p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-89ER51114. (CONF-900602–21: 17. European conference on controlled fusion and plasma heating, Amsterdam (Netherlands), 25-29 Jun 1990). Order Number DE91001316. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Recent results from the DIII-D tokamak have provided significant contributions to the understanding of many of the elements of tokamak physics and the application of this understanding to the design of next generation devices including ITER and CIT. The limitations of magnetohydrodynamics stability on the values of plasma beta (the ratio of kinetic pressure to the containing pressure of the magnetic field) that can be attained has been experimentally demonstrated and found to be described by existing theory. Values of beta (10.7%) well in excess of those required for proposed devices (ITER and CIT) have been demonstrated. Regimes of confinement (H-mode) have been established that scale favorably to proposed next generation devices, and experiments demonstrating the dependence of the energy confinement on plasma size have been completed. Understanding of confinement is rapidly developing especially in the areas of bulk transport and the role of turbulence in the plasma edge. Key experimental results in areas of plasma transport and edge plasma phenomena are found to be in agreement with theories based on short wavelength turbulence. Control of the divertor heat loads and impurity influx has been demonstrated, and new progress has been made in the understanding of plasma edge phenomena. Experiments with ion Bernstein wave heating have not found regimes in which these waves can produce effective central ion heating. Electron cyclotron current drive experiments have demonstrated 70 kA of driven current in 400 kA discharges.

54277 (IAEA-CN–53/F-3-1) **Energy and particle confinement in ITER [International Thermonuclear Experimental Reactor].** Uckan, N.A. (Oak Ridge National Lab., TN (USA)); Yushmanov, P.N.; Mukhovatov, V.S.; Parail, V.V.; Putvinskii, S.; Takizuka, T.; Tsunematsu, T.; Yoshino, R.; Borrass, K.; Engelmann, F.; Kardaun, O.; Lackner, K.; Callen, J.D. Oak Ridge National Lab., TN (USA). [1990]. 6p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. (CONF-901025–12: 13. international conference on plasma physics and controlled nuclear fusion research, Washington, DC (USA), 1-6 Oct 1990). Order Number DE91001623. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

ITER will require a level of energy (τ_E) and particle (τ_p) confinement sufficient for reaching ignition and extended burn of DT plasmas, with steady-state, high-Q ($Q = P_{fusion}/P_{aux} = 5P_{\alpha}/P_{aux}$) operation as an ultimate goal. This translates into a required confinement capability of $T_i(0)n_{DT}(0)\tau_E \sim 4–8 \times 10^{21}$ keV·s/m^3 for $Q \sim 5–\infty$ [where $T_i(0)$ is the central ion temperature, $n_{DT}(0)$ is the central DT fuel ion density, τ_E is the global energy confinement time]. In addition, $\tau_p{}^{He}/\tau_E < 10$ is required to ensure that the thermal α-particle (He) accumulation (n_{He}/n_e) is less than 10% (where $\tau_p{}^{He}$ is the global thermal alpha particle containment time). Furthermore, the tritium fuel burnup fraction under nominal burn conditions

must be greater than 1.5%. While the ITER $Tn\tau_E$ requirement is about ten times the highest value achieved in JET [3], the extrapolation in plasma physics parameters is less. If β (ratio of plasma kinetic pressure to magnetic pressure), ν^* (collisionality), and ρ/a (ratio of the ion gyroradius to the plasma minor radius) are taken as the relevant dimensionless parameters to characterize the plasma, the extrapolation from present JET performance to ITER is a factor $\leq$2. The ITER concept is based on the expectation that H-mode confinement can be achieved for long pulse. This paper covers the energy and particle confinement issues for ITER. 15 refs.

54278 (IAEA-CN–53/F-3-5) **ITER [International Thermonuclear Experimental Reactor] current drive and heating systems.** Lindquist, W. (Lawrence Livermore National Lab., CA (USA)); Nevins, W.; Casci, F.; Hopman, H.; Rebuffi, L.; Sironi, M.; Wegrowe, J.G.; Fujisawa, N.; Kimura, H.; Parail, V.; Swain, D. International Atomic Energy Agency, Vienna (Austria); Oak Ridge National Lab., TN (USA). [1990]. 8p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. (CONF-901025–13: 13. international conference on plasma physics and controlled nuclear fusion research, Washington, DC (USA), 1-6 Oct 1990). Order Number DE91001562. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

This report discusses the following systems used to heat the ITER tokamak: electron cyclotron; lower hybrid; neutral beam injection; and ion cyclotron. 5 refs., 4 figs. (LSP)

54279 (ORNL/FTR–3775) **[The physics of highly charged Ions]: Foreign trip report, September 8, 1990–September 27, 1990.** Phaneuf, R.A. Oak Ridge National Lab., TN (USA). 12 Oct 1990. 19p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE91001152. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The Fifth International Conference on the Physics of Highly Charged Ions drew more than 200 participants, providing an excellent overview of this growing field. Important technical developments and experimental results in electron-ion collisions were reported. The merging of fast ion beams from accelerators or storage rings with advanced high-intensity electron-beam targets has yielded data of unprecedented quality on radiative and dielectronic recombination, providing stringent tests of theory. Long-awaited technical innovations in electron-impact excitation measurements were also reported. The level of activity in multicharged ion-surface interactions has increased. More sophisticated experimental studies of the neutralization process have shown the inadequacy of previously accepted mechanisms, and theoretical activity in this area is just being initiated. The IAEA meetings addressed atomic and molecular data needs for fusion research, with ITER providing a key focus. Such data are especially critical to modeling and diagnostics of the edge plasma. The ALADDIN data base system has been universally accepted and has streamlined the exchange of numerical data among data centers and the fusion community. The IAEA continues to play a pivotal role in the identification of data needs, and in the coordination of data compilation and research activities for fusion applications.

54280 (ORNL/TM–11521) **Physics models in the toroidal transport code PROCTR.** Howe, H.C. Oak Ridge National Lab., TN (USA). Aug 1990. 84p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE91000519. Source: NTIS, PC A05/MF A01; OSTI; INIS; GPO Dep.

The physics models that are contained in the toroidal transport code PROCTR are described in detail. Time- and space-dependent models are included for the plasma hydrogenic-ion, helium, and impurity densities, the electron and ion temperatures, the toroidal rotation velocity, and the toroidal current profile. Time- and depth-dependent models for the trapped and mobile hydrogenic particle concentrations in the wall and a time-dependent point model for the number of particles in the limiter are also included. Time-dependent models for neutral particle transport, neutral beam deposition and thermalization, fusion heating, impurity radiation, pellet injection, and the radial electric potential are included and recalculated periodically as the time-dependent models evolve. The plasma solution is obtained either in simple flux coordinates, where the radial shift of each elliptical, toroidal flux surface is included to maintain an approximate pressure equilibrium, or in general three-dimensional torsatron coordinates represented by series of helical harmonics. The detailed coupling of the plasma, scrape-off layer, limiter, and wall models through the neutral transport model makes PROCTR especially suited for modeling of recycling and particle control in toroidal plasmas. The model may also be used in a steady-state profile analysis mode for studying energy and particle balances starting with measured plasma profiles.

54281 (SAND–90-1387C) **Characterization of electron cyclotron resonance hydrogen plasmas.** Outten, C.A. (Michigan Univ., Ann Arbor, MI (USA). Dept. of Nuclear Engineering); Barbour, J.C.; Wampler, W.R. Sandia National Labs., Albuquerque, NM (USA). [1990]. 20p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-901035–9: 37. national American Vacuum Society symposium, Toronto (Canada), 8-12 Oct 1990). Order Number DE91001250. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Electron cyclotron resonance (ECR) plasmas yield low energy and high ion density plasmas. The characteristics downstream of an ECR hydrogen plasma were investigated as a function of microwave power and magnetic field. A fast-injection Langmuir probe and a carbon resistance probe were used to determine plasma potential (V_p), electron density (N_e), electron temperature (T_e), ion energy (T_i), and ion fluence. Langmuir probe results showed that at 17 cm downstream from the ECR chamber the plasma characteristics are approximately constant across the center 7 cm of the plasma for 50 Watts of absorbed power. These results gave V_p = 30 $\pm$ 5 eV, $N_e = 1 \times 10^8$ cm^{-3}, and T_e = 10–13 eV. In good agreement with the Langmuir probe results, carbon resistance probes have shown that $T_i \leq 50$ eV. Also, based on hydrogen chemical sputtering of carbon, the hydrogen (ion and energetic neutrals) fluence rate was determined to be 1×10^{16}/cm^2-sec. at a pressure of 1×10^{-4} Torr and for 50 Watts of absorbed power. 19 refs.

54282 (UCRL-JC–103883) **Soft x-ray detection with diamond photoconductive detectors.** Kania, D.R.; Pan, L.; Kornblum, H.; Bell, P.; Landen, O.N.; Pianetta, P. Lawrence Livermore National Lab., CA (USA). 4 May 1990. 9p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-900557–14: 8. topical conference on high-temperature plasma diagnostics, Hyannis, MA (USA), 6-10 May 1990). Order Number DE91000418. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Photoconductive detectors fabricated from natural IIa diamonds have been used to measure the x-ray power emitted from laser produced plasmas. The detector was operated without any absorbing filters to distort the x-ray power measurement. The 5.5 eV bandgap of the detector material practically eliminates its sensitivity to scattered laser radiation thus permitting filterless operation. The detector response time or carrier life time was 90 ps. Excellent agreement was achieved between a diamond PCD and a multichannel photoemissive diode array in the measurement of radiated x-ray power and energy. 4 figs.

54283 **X-pinch soft x-ray source for microlithography.** Hammer, D.A. (Cornell Univ., Ithaca, NY (USA). Lab. of Plasma Studies); Kalantar, D.H.; Mittal, K.C.; Qi, N. 18p. Laboratory of Plasma Studies, Cornell University, Ithaca, NY (USA) (1990).

Technical Paper LPS90-6.

A novel soft x-ray source for submicron resolution microlithography is described. Exploratory experiments with the x-pinch dense plasma radiation source have been performed using a 500 kA, 40 ns pulsed power generator. Several tens of joules of aluminum K-shell radiation (1.6–1.7 keV) and about 85 J of magnesium K-shell radiation (1.3–1.5 keV) have been produced in a source approximately 0.5 mm or less in diameter during a single pulse. The yield increased rapidly with current, implying the possibility of single pulse exposure of a resist at a distance of 20 cm using a <1 MA pulser.

54284 **Steady state Z-pinch profiles.** Auer, P.L. (Cornell Univ., Ithaca, NY (USA). Lab. of Plasma Studies). 14p. Laboratory of Plasma Studies, Cornell University, Ithaca, NY (USA) (1990).

Technical Paper LPS90-5.

The one dimensional, steady-state solutions of a Z-pinch are re-examined, especially to see how the competition between ohmic heating and radiative cooling affects the profiles of plasma properties. It is found that the profiles are sensitive to the particular model adopted for the transport of current (resistivity) and energy (thermal conductivity). Strictly speaking, none of the solutions examined provides a physically satisfactory solution for pinch equilibria within a finite radius. Nor is there clear evidence that equilibrium solutions contract in radius as the pinch current is increased and the Pease value is approached, although in some models a singularity of sorts occurs at a critical value of the current. As a consequence, one might question the usefulness of one dimensional, stead-state formulations in trying to understand the dynamics of high current Z-pinches and their apparent stability.

54285 A ponderomotive force model for Raman scattering in a nonuniform plasma. Amini, B. (Cornell Univ., Ithaca, NY (USA). Lab. of Plasma Studies); Roth, I.S. 12p. Laboratory of Plasma Studies, Cornell University, Ithaca, NY (USA) (1990).

Technical Paper LPS90-2.

The authors consider formation of a density cavity near the quarter-critical density ($n_c/4$) surface in a laser-produced plasma due to the ponderomotive force of plasma waves. They show that inside the cavity the plasma waves are absolutely unstable. The threshold for this temporally growing mode is smaller than the Raman threshold near $n_c/4$. These results can explain the observed distinct features of Raman light spectra and provide a measure of the electrostatic wave energy in experiments.

54286 Dependence of relativistic backward wave oscillator properties on effective beam gamma. Butler, J.M. (Cornell Univ., Ithaca, NY (USA). Lab. of Plasma Studies); Wharton, C.B.; Furukawa, S. 15p. Laboratory of Plasma Studies, Cornell University, Ithaca, NY (USA) (1989).

Technical Paper LPS89-7.

The operation of a Backward Wave Oscillator (BWO) is shown to be critically dependent on the energy of the slow-space charge wave of the electron beam. Experimental work parameterizing the dependence of microwave frequency on effective beam energy, γ_{beam}, reveals that through an understanding of electron beam dynamics a BWO could be systematically tuned through a desired frequency range while maintaining high power of a few hundred megawatts and narrow frequency bandwidth, which here was 400 MHz. Through variation of γ_{beam}, 1.2 to 1.5 for their experiment, the authors observe the lack of scaling of peak microwave power with the kinetic energy of the electron beam for the $\gamma_{beam} > 1.32$. This effect was previously found in numerical simulation. The authors look for an explanation of this effect by examining the relationship of beam current to spacecharge-limiting current for increasing γ_{beam}. Dramatic evidence of pulse shortening, a phenomenon known to relativistic oscillators is also seen and some preliminary remarks are made.

54287 Spectroscopic determination of the electrostatic potential profile in a plasma-prefilled ion diode. Coleman, M.D. (Maxwell Labs., Inc., San Diego, CA (USA)); Hammer, D.A. 8p. Laboratory of Plasma Studies, Cornell University, Ithaca, NY (USA) (1989).

Technical Paper LPS89-3.

The electrostatic potential profile in the accelerating gap in a plasma-prefilled magnetically insulated intense pulsed ion beam diode has been determined using laser induced fluorescence spectroscopy. Results for a 300–400 kV planar diode are presented, both with and without an electron emitting vane protruding from the cathode. In both cases, a 5–6 mm accelerating gap forms in the 10^{12}–10^{13}/cm^3 plasma in a few ns. The experimental potential profiles are not consistent with electrons confined to a sheath near the cathode. Rather, electrons are required throughout the gap to explain the observations.

54288 Magnetosonic wave generation by super-Alfvenic ion ring propagation in plasma. Schamiloglu, E. (New Mexico Univ., Albuquerque, NM (USA). Dept. of Electrical and Computer Engineering); Greenly, J.B.; Hammer, D.A. 11p. Laboratory of Plasma Studies, Cornell University, Ithaca, NY (USA) (1989).

Technical Paper LPS89-4.

A weakly diamagnetic rotating proton beam propagating at about four times the Alfven speed along a magnetized hydrogen plasma column generated magnetosonic waves when the beam rise time was less than about three radial Alfven transit times. The waves were collisionally damped and the damping increased as the induced cross-field plasma current became stronger. The authors' beam and plasma conditions suggest that the damping is due to an enhanced collision frequency resulting from a modified two-stream instability. The plasma temperature increased by about 1 eV,which can be explained by classical Coulomb collisions between the ring protons and plasma electrons.

54289 Measurements of Faraday rotation in TFTR plasmas. Ma, C.H. (Oak Ridge National Lab., Oak Ridge, TN (US)); Hutchinson, D.P.; Sluis, K.L.V.; Mansfield, D.K.; Park, H.; Johnson, L.C. pp. H19 of Proceedings of the 6th topical conference on high temperature plasma diagnostics. Princeton Plasma Physics Laboratory, Princeton, NJ (USA) (1986). pp. 92 DOE Contract AC02-76CH03073. (CONF-860324–: 6. topical conference on high temperature plasma diagnostics, Hilton Head Island, SC (USA), 9-13 Mar 1986).

This paper presents results of simultaneous measurements of line electron density and poloidal field-induced Faraday rotation on the multichannel FIR interferometer/polarimeter on TFTR. The procedures and results of the calibration are described. The effects of various errors in the measurement, as well as the problem of cross coupling laser beams, are studied.

54290 Megagauss magnetic field production using compact toroidal plasmas. Hackett, K.E. (Weaspons Lab., Kirtland AFB, NM (US)); Baker, W.L.; Beason, J.D.; Clouse, C.J.; Degnan, J.H.; Dietz, D.; Rowley, J.E.; Sovinic, C.R.; Buff, J.S.; Frese, M.H.; Peterkin, R.E.; Roderick, N.F. pp. 55-64 of Megagauss fields and pulsed power systems. Titov, V.M.; Shvetsov, G.A. Nova Science Publishers, Inc., Commack, NY (USA) (1990). pp. 859 (CONF-890710–: 5. international conference on megagauss magnetic field generation and related topics, Novosibirsk (USSR), 3-7 Jul 1989).

Compact toroids are minimum magnetic energy configurations of plasma which have linked poloidal and toroidal flux. Compact toroids can be accelerated in a coaxial electromagnetic launcher geometry. After acceleration, the plasma can be self-similarly focused by propagating the rapidly moving plasma between converging metal electrodes. It is possible to produce megagauss magnetic fields by this method. A zero-dimensional code, RAC, has been used to predict focused compact toroid parameters. Using the MACH2 2-D magnetohydrodynamics code, the authors have computationally studied the production of compact toroidal plasmas using a magnetized coaxial plasma gun. An experiment which will use a SHIVA Star capacitor bank (9.4 MJ, 120 KV) to compress, accelerate, and focus compact toroids has started. The results of computer simulations and the status of the experiments are presented.

54291 Spectra of highly-ionized atoms. Reader, J. (Atomic and Plasma Radiation Div., National Bureau of Standards, Gaithersburg, MD (US)); Sugar, J.; Kaufman, V. pp. 66-70 of Short and ultrashort wavelength lasers. Jones, C.R. Society of Photo-Optical Instrumentation Engineers, Bellingham, WA (USA) (1988). pp. 193 (CONF-8801144–: Short and ultrashort wavelength lasers meeting, Los Angeles, CA (USA), 14-15 Jan 1988).

Recent work on the spectra of laser- produced plasmas and tokamaks has led to the observation of long sequences of isoelectronic ions extending to very high ionic charge states. The measurements of the wavelengths and energy levels provide data that are important for the development of x-ray lasers. In addition to contributing to a knowledge of the energy levels and transitions of possible lasing media, the data provide reference lines for wavelength calibration of x-ray laser experiments and reference data for testing theoretical methods used for predicting the properties of lasing ions.

54292 Imploding co-axial krypton gas puffs as a potential x-ray laser. Davis, J. (Naval Research Lab., Plasma Radiation Branch, Washington, DC (US)); Clark, R.; Apruzese, J.; Kepple, P. pp. 32-38 of Short and ultrashort wavelength lasers. Jones, C.R. Society of Photo-Optical Instrumentation Engineers, Bellingham,

WA (USA) (1988). pp. 193 (CONF-8801144–: Short and ultrashort wavelength lasers meeting, Los Angeles, CA (USA), 14-15 Jan 1988).

A scheme employing neonlike krypton ions is under intensive theoretical and experimental investigation to determine the feasibility of developing a pulsed-power driven laboratory x-ray laser. The scheme depends on discharging 100's of kilojoules of electrical energy through co-axial cylindrical krypton gas puffs generating a dense, hot, uniform, homogeneous, and highly ionized krypton plasma. The dynamics of energy absorption are such that self- generated magnetic fields compress and accelerate radially inward the outer plasma with speeds approaching 5×10^7 cm/sec. When the outer plasma impinges and stagnates on the inner plasma, shock waves are sent through the system as the plasma reverberates and bounces outward. Near the interface between the two interacting plasmas, and along the axis, conditions appear to be conducive to the establishment of a population inversion with the subsequent emission of coherent soft x-rays with measurable gain. The theory, analysis, and numerical simulations are based on a fully coupled self- consistent one-dimensional non-LTE radiation hydrodynamics model including the effects of opacity and radiation transport.

54293 X-ray laser studies at LLE. Yaakobi, B. (Lab. for Laser Energetics, Univ. of Rochester, Rochester, NY (US)); Shvarts, D.; Boehly, T.; Audebert, P.; Epstein, R.; Boswell, B.; Richardson, M.C.; Soures, J.M. pp. 9-19 of Short and ultrashort wavelength lasers. Jones, C.R. Society of Photo-Optical Instrumentation Engineers, Bellingham, WA (USA) (1988). pp. 193 (CONF-8801144–: Short and ultrashort wavelength lasers meeting, Los Angeles, CA (USA), 14-15 Jan 1988).

This paper reports new target geometries for collisional excitation x-ray laser experiments (in nickel) proposed, analyzed and experimentally studied on the GDL laser. Experiments using a short line focus lens with new target geometries showed general agreement with predictions. The new geometries are designed to yield a higher gain and reduced refraction due to: a higher plasma density, a wider lateral density profile, and a concave lateral density profile. These new geometries were: two parallel exploding (thin) foils, irradiated from one side only; two ablating (thick) foils, one of which is irradiated on its inner face, and an exploding foil in front of an ablating foil, irradiated by a single laser beam incident on the thin foil. New experiments with a long line focus are in progress. The intensity ratio of Ne-like and F-like Ni lines is used to deduce the temperature, and these results together with the absolute intensity yields the density profile.

54294 Pulsed-power driven, photopumped x-ray laser research at the Naval Research Laboratory. Young, F.C. (Naval Research Lab., Washington, DC (US)); Mosher, D.; Ottinger, P.F.; Rogerson, J.E.; Stephanakis, S.J.; Scherrer, V.E.; Thornhill, J.W.; Apruzese, J.P.; Commisso, R.J.; Cooperstein, G.; Davis, J.; Mehlman, G.; Welch, B.L. pp. 2-8 of Short and ultrashort wavelength lasers. Jones, C.R. Society of Photo-Optical Instrumentation Engineers, Bellingham, WA (USA) (1988). P of (CONF-8801144–: Short and ultrashort wavelength lasers meeting, Los Angeles, CA (USA), 14-15 Jan 1988).

Resonant photopumping is an attractive and potentially very efficient technique for achieving x-ray lasing in plasmas. At the Naval Research Laboratory the authors are pursuing the realization of one of the most promising photopumped schemes wherein heliumlike sodium pumps heliumlike neon. The theoretical side of this research has revealed the conditions required for the sodium and neon plasmas to maximize the possibility of photopumped fluorescence and lasing. On the experimental side, a powerful (25 GW) z-pinch source of sodium line pumping radiation has been developed and characterized. A separate neon plasma, driven by part of the return current from the sodium-bearing plasma, has been deployed side-by-side with respect to the sodium line source at a distance of 5 cm. The presence of photopumping has been indicated in fluorescing spectra. The remaining steps toward achievement of an x-ray laser are reducing the spatial separation of the pumped and pumping plasmas and increasing the pump line power of the pumping, sodium-bearing plasma.

54295 Absorption experiments on electron-beam pumped rare gases. McCown, A.W. (Los Alamos National Lab., NM (USA)); Rose, E.A.; Krohn, B.J.; Hanson, D.E.; Czuchlewski, S.J. pp. 102-109 of Lasers '89. Harris, D.G.; Shay, T.M. STS Press, McLean, VA (USA) (1990). pp. 1159 (CONF-891261–: Lasers '89: 12th international conference on lasers and applications, New Orleans, LA (USA), 3-8 Dec 1989).

Absorption experiments have been performed on electron-beam pumped rare gases (argon and krypton) as a function of pump power at 248.4 nm and 257.3 nm. Energy deposition into the gas was varied by attenuating the electron beam with one or two stainless steel screens by varying the gas density. The results from two separate energy deposition diagnostics agreed to within 20%. The Los Alamos National Laboratory KrF kinetics code calculations came into agreement with experimental results after the Ar_2^* absorption cross section was lowered to 1.8×10^{-18} cm^2 and the Ar_2^* radiative decay rate was increased to 4.4×10^6 s^{-1}.

54296 Gasdynamic phenomena in nuclear-reactor-pumped lasers. Torczynski, J.R. (Sandia National Labs., Albuquerque, NM (USA)). pp. 255-262 of Lasers '89. Harris, D.G.; Shay, T.M. STS Press, McLean, VA (USA) (1990). pp. 1159 DOE Contract AC04-76DP00789. (CONF-891261–: Lasers '89: 12th international conference on lasers and applications, New Orleans, LA (USA), 3-8 Dec 1989).

In nuclear-reactor-pumped lasers, the fission-fragment heating is spatially nonuniform and as such induces gas motion. The competing effects of heating nonuniformity and thermal conduction on overall gas motion and laser optical behavior are examined, and a parameter is developed which categorized the induced gas flow into three regimes. The effect of fission-fragment heating on perturbations in the gas density field is also examined, and a scaling relation describing the reduction of the rms density perturbation is developed in terms of the pressure rise produced by the heating.

54297 Multi-megajoule shaped solid liner implosions. Degnan, J.H. (Weapons Lab., Kirtland AFB, NM (US)); Baker, W.L.; Beason, J.D.; Clouse, C.J.; Dietz, D.; Hall, D.J.; Holmes, J.L.; Price, D.W.; Sovinic, C.R.; Graham, J.D.; Lopez, E.A.; Alme, M.L.; Coffey, S.K.; Seiler, S.W.; Turchi, P.J.; Buff, J.S.; Frese pp. 623-630 of Megagauss fields and pulsed power systems. Titov, V.M.; Shvetsov, G.A. Nova Science Publishers, Inc., Commack, NY (USA) (1990). pp. 859 (CONF-890710–: 5. international conference on megagauss magnetic field generation and related topics, Novosibirsk (USSR), 3-7 Jul 1989).

Electromagnetic implosions of quasi-cylindrical shaped aluminum liners which remain solid are discussed. The approximate liner parameters are 3 to 4 cm radius, 4 cm height, and ~ 0.1 cm thick. The liners are driven by a Shiva Star capacitor bank direct discharge. Discharge parameters are 1300 microfarads, 84 kilovolt charging voltage, ~ 30 nanohenries total initial inductance (including load). The axial discharge current rises to 14 megamperes in ~ 8 microseconds. The implosion time is ~ 12 microseconds. Diagnostics include inductive current and capacitive voltage probes, magnetic probes, and x-radiography. Conical liner implosion data are shown.

54298 Multi-megajoule magnetic reconnection experiment. Degnan, J.H. (Weapons Lab., Kirtland AFB, NM (US)); Baker, W.L.; Holmes, J.L.; Price, D.W.; Cowan, M.; Graham, J.D.; Lopez, E.A.; Ralph, D.; Roderick, N.F. pp. 631-642 of Megagauss fields and pulsed power systems. Titov, V.M.; Shvetsov, G.A. Nova Science Publishers, Inc., Commack, NY (USA) (1990). pp. 859 (CONF-890710–: 5. international conference on megagauss magnetic field generation and related topics, Novosibirsk (USSR), 3-7 Jul 1989).

An experiment to combine many medium energy, current coaxial gun discharges into two high energy, current discharges is discussed. Multiple sub-megampere DPF-like guns are directed radially inward. Their discharges combine via magnetic reconnection to form two several megampere co-axial discharges. Experimental results and relevant 2D simulations are discussed. Diagnostics include current, voltage, fast photography, neutron and x-ray detectors.

54299 Thermal transport during electron cyclotron heating in the TEXT tokamak. Sing, D.C. (The Fusion Research Center, The University of Texas at Austin, Austin, TX (USA)); Bravenec, R.V.; Foster, M.S.; Gentle, K.W.; Phillips, P.E.; Ouroua, A.;

Richards, B.; Smith, B.A.; Wiley, J.C.; Wootton, A.J.; Austin, M.E. *AIP Conference Proceedings (American Institute of Physics) (USA),* 190(1): 76-79 (1 Jul 1989). DOE Contract FG05-88ER53267. (CONF-8905120–: 8. topical conference on radio frequency power in plasmas, Irvine, CA (USA), 1-3 May 1989).

Electron Cyclotron Heating experiments have been performed on the TEXT tokamak using Varian gyrotron. Some degradation of electron energy confinement is observed for sawtoothing and non-sawtoothing discharges. Sharp electron temperature profiles are produced in high-q discharges by extremely localized ECH power deposition. (AIP)

54300 Simulations of lower hybrid current drive and ohmic transformer recharge. Fuchs, V. (Centre Canadien de Fusion Magnetique, Varennes, Quebec (Canada)); Shkarofsky, I.P.; Cairns, R.A.; Bonoli, P. *AIP Conference Proceedings (American Institute of Physics) (USA),* 190(1): 134-137 (1 Jul 1989). DOE Contract AC02-78ET51013. (CONF-8905120–: 8. topical conference on radio frequency power in plasmas, Irvine, CA (USA), 1-3 May 1989).

The Bonoli-Englade code has been modified: (a) to allow launching and evolution of narrow Brambilla spectra, (b) PID feedback control of the plasma current is added, and (c) a new rf current diffusion model is presented. This is applied to the Tokamak de Varennes, in which it is planned to use lower-hydrid current drive to extend operation at full current for the entire duration (30 s) of the toroidal field. The modified code shows that 200 kA of current could be maintained in a steady state with about 1 MW of LH power at 3.7 GHz, and $n_0=4\times10^{19}$ m^{-3}. With the same power, in an alternating ohmic-rf scenario, the ohmic transformer could be reacharged by 2 V s in about 4 s at a slightly reduced density.

54301 Role of alpha particle damping in fast wave current drive and heating. Mau, T.K. (Institute of Plasma and Fusion Research, University of California, Los Angeles, CA (USA)). *AIP Conference Proceedings (American Institute of Physics) (USA),* 190(1): 158-161 (1 Jul 1989). DOE Contract FG03-88ER52151. (CONF-8905120–: 8. topical conference on radio frequency power in plasmas, Irvine, CA (USA), 1-3 May 1989).

The impact of energetic alpha particle wave absorption on the range of frequencies for efficient fast wave current drive and heating in a fusion reactor is investigated. The energetic alpha damping decrement is calculated, using a slowing down distribution function, and compared to electron and fuel ion damping over a wide range of frequencies. A combination of strong alpha damping and edge electron absorption in the higher ion harmonic regime limits core fast wave current drive to the lower harmonics (l=2,3).

54302 ICRF and ICRF plus neutral beam heating experiments on TFTR. Colestock, P. (Princeton University, Princeton, NJ (USA)); Cavallo, A.; Dorland, W.; Hosea, J.; Greene, G.; Hammett, G.; Hendel, H.W.; Howell, B.; Jaehnig, K.; Kaita, R.; Medley, S.S.; Phillips, C.K.; Roquemore, A.L.; Schilling, G.; Stevens, J.; Statton, BTFTR Group. *AIP Conference Proceedings (American Institute of Physics) (USA),* 190(1): 189-196 (1 Jul 1989). DOE Contract AC02-76CH03073. (CONF-8905120–: 8. topical conference on radio frequency power in plasmas, Irvine, CA (USA), 1-3 May 1989).

An ICRF heating experiment was performed on TFTR. A comparison of the antenna loading with a 1-D theory reproduces much of the observed behavior. Good agreement between theory and experiment regarding details of the ion distributions has also been obtained. (AIP)

54303 Fast wave current drive above the slow wave density limit. McWilliams, R. (Department of Physics, University of California, Irvine, CA (USA)); Sheehan, D.P.; Wolf, N.S.; Edrich, D. *AIP Conference Proceedings (American Institute of Physics) (USA),* 190(1): 162-165 (1 Jul 1989). DOE Contract FG03-85ER53210. (CONF-8905120–: 8. topical conference on radio frequency power in plasmas, Irvine, CA (USA), 1-3 May 1989).

Fast wave and slow wave current drive near the mean gyrofrequency were compared in the Irvine Torus using distinct phased array antennae of similar principal wavelengths, frequencies, and input powers. The slow wave current drive density limit was measured for $50\omega_{cd}\leq\omega\leq500\omega_{cd}$ and found to agree with trends in tokamaks. Fast wave current drive was observed at densities up to the operating limit of the torus, demonstrably above the slow wave density limit.

54304 Spectral shaping and phase control of a fast-wave current drive antenna array. Baity, F.W. (Oak Ridge National Laboratory, Oak Ridge, TN (USA)); Gardner, W.L.; Goulding, R.H.; Hoffman, D.J.; Ryan, P.M. *AIP Conference Proceedings (American Institute of Physics) (USA),* 190(1): 214-217 (1 Jul 1989). DOE Contract AC05-84OR21400. (CONF-8905120–: 8. topical conference on radio frequency power in plasmas, Irvine, CA (USA), 1-3 May 1989).

The requirements for antenna design and phase control circuitry for a fast-wave current drive (FWCD) array operating in the ion cyclotron range of frequencies are considered. The design of a phase control system that can operate at arbitrary phasing over a wide range of plasma-loading and strap-coupling values is presented for a four-loop antenna array, prototypical of an array planned for the DIII-D tokamak (General Atomics, San Diego, California).

54305 Fast wave current drive modeling for ITER and prospects for a near-term proof of principle experiment. Batchelor, D.B. (Oak Ridge National Laboratory, Oak Ridge, TN (USA)); Jaeger, E.F.; Carter, M.D.; Swain, D.W. *AIP Conference Proceedings (American Institute of Physics) (USA),* 190(1): 218-221 (1 Jul 1989). DOE Contract AC05-84OR21400. (CONF-8905120–: 8. topical conference on radio frequency power in plasmas, Irvine, CA (USA), 1-3 May 1989).

A 3D full-wave solution of the fasst wave equations in tokamak geometry is presented together with power absorption and current drive profiles. This 3D code models the launched antenna spectrum with radial focusing, includes toroidal eigen-mode effects and effects of ion cyclotron harmonic and alpha particle damping. (AIP)

54306 Ion energy and plasma measurements in the near field of an ICRF antenna. Caughman, J.B.O. II (University of Illinois, Urbana, IL (USA)); Ruzic, D.N.; Hoffman, D.J. *AIP Conference Proceedings (American Institute of Physics) (USA),* 190(1): 226-229 (1 Jul 1989). DOE Contract AC05-84OR21400. (CONF-8905120–: 8. topical conference on radio frequency power in plasmas, Irvine, CA (USA), 1-3 May 1989).

Plasma properties and ion energies have been measured in the near field of an ICRF antenna to determine the effects of rf fields in a magnetized plasma sheath on the energy of ions incident on the surface of the Faraday shield. A resonant loop antenna with a two-tier Faraday shield was used on the RF Test Facility at Oak Ridge National Laboratory (ORNL). The magnetic field near the antenna is ~2 kG, and the plasma density is $\sim10^{11}$ cm^{-3} with an electron temperature of 6–10 eV. The time-varying floating potential was measured with a capacitively coupled probe, and the time-averaged electron temperature electron density, and floating potential were measured with a Langmuir probe. Both probes were canned poloidally in front of the antenna, parallel to the current strap. Diagnostic for measuring ion energies included a gridded energy analyzer located directly below the antenna. Measured ion energies are compared with predictions from a computational model for determining the energy and angular distibution of ions incident on a surface in a magnetized plasma sheath with a time-varying plasma potential.

54307 Mode conversion at the higher ion cyclotron harmonics. Chiu, S.C. (General Atomics, San Diego, CA (USA)); Chan, V.S.; Harvey, R.W.; Porkolab, M. *AIP Conference Proceedings (American Institute of Physics) (USA),* 190(1): 230-233 (1 Jul 1989). DOE Contract AC03-89ER53277. (CONF-8905120–: 8. topical conference on radio frequency power in plasmas, Irvine, CA (USA), 1-3 May 1989).

It has been demonstrated that mode conversion of fast waves to ion Bernstein waves can be calculated from a reduced second order differential equation for the wave fields rather than the 4th order equations used in earlier studies near the ion-ion hybrid resonance and the second harmonic resonance. Here the underlying justification of the method is discussed. It is shown that the method works for high harmonic resonances and an analytical formula for the tunneling coefficient is derived. The result is a generalization of a previous result obtained by Ngan and Swanson and is applicable when $\kappa_\perp\rho_i$ is large. Recently, there is interest in using fast waves

for current drive at high ion cyclotron harmonics frequencies in tokamaks. Generally, the fast wave will encounter ion cyclotron harmonics within the plasma cross-section. For efficient current drive, the minimization of the mode conversion processes sets restrictions to the choice of frequencies and magnetic fields. This is discussed using the derived formula.

54308 Scattering of an ICRF magnetosonic wave by plasma density turbulence. Cook, D.R. (Lawrence Berkeley Laboratory, Berkeley, CA (USA)); Kaufman, A.N. *AIP Conference Proceedings (American Institute of Physics) (USA),* 190(1): 238-241 (1 Jul 1989). DOE Contract AC03-76SF00098. (CONF-8905120–: 8. topical conference on radio frequency power in plasmas, Irvine, CA (USA), 1-3 May 1989).

A fast ICRF magnetosonic wave, launched into a tokamak plasma, scatters off turbulent density fluctuations in the plasma edge. We use cold-fluid theory to calcualte the angular distribution of the scattered wave and find it to be predominantly perpendicular to the incident wavevector for second harmonic majority heating. We calculate the mean free path and find it to be large compared to the size of tokamak devices. Therefore, scattering of ICRF magnetosonic waves by density turbulence is an utterly negligible effect.

54309 ICRF antenna designs for CIT and alcator C-Mod. Goulding, R.H. (Oak Ridge National Laboraotry, Oak Ridge, TN (USA)); Baity, F.W.; Goranson, P.L.; Hoffman, D.J.; Ryan, P.M.; Taylor, D.J.; Yugo, J.J. *AIP Conference Proceedings (American Institute of Physics) (USA),* 190(1): 250-253 (1 Jul 1989). DOE Contract AC05-84OR21400. (CONF-8905120–: 8. topical conference on radio frequency power in plasmas, Irvine, CA (USA), 1-3 May 1989).

An ion cyclotron range of frequencies (ICRF) launcher for the Compact Ignition Tokamak (CIT) has been designed. This launcher incorporates for current straps in a 2×2 configuration. The current straps consist of end-fed loops that are grounded in the middle. An antenna similar in geometry, size, and feed configuration to a single strap of the CIT launcher will be built for use of Alcator C-Mod. The design must provide maximum power levels of 4 MW/port for CIT and 2 MW/port for C-Mod, pulse lengths of 5–10 s for CIT and 1 s for C-Mod, and power densities up to 2 kW/cm^2. The design uses a Faraday shield consisting of Inconel rods with mechanically attached graphite tiles; the shield and the current strap are cooled by radiating to a gas-cooled backplane. A feed configuration compatible with the end-fed antenna design has been developed and features tunability in three bands in the range 65–130 MHz. It uses an external resonant loop with integral tuning elements. It has been designed to maximize power handling capabilities, minimize space requirements, and facilitate remote handling.

54310 Analysis of charge exchange measurments during ICRF and ICRF+NBI heating in TFTR. Hammett, G.W. (Princeton Plasma Physics Laboratory, P.O. Box 451, Princeton NJ (USA)); Dorland, W.; Kaita, R.; Medley, S.S.; Smithe, D.N.; Colestock, P.L. *AIP Conference Proceedings (American Institute of Physics) (USA),* 190(1): 258-261 (1 Jul 1989). DOE Contract AC02-76CH03073. (CONF-8905120–: 8. topical conference on radio frequency power in plasmas, Irvine, CA (USA), 1-3 May 1989).

Charge-exchange measurements during ICRF-only and combined ICRF (2MW) and NBI (7 MW) heating have been made with vertically-viewing mass-resolving analyzers. We have observed an enhancement of the deuterium spectrum above the beam injection energy, providing evidence of second harmonic acceleration of beam ions by the ICRF waves. The measured spectra are in resonable agreement with the predictions of a comprehensive ICRF+NBI code, given the measurement error bars and the simulation uncertainties due to the hydrogen concentration, RF power profile, and effects of sawteeth. In the ICRF-only case, we present measurements from a toroidal field scan which show that the flux of 150 keV H-minority ions varies by a factor of 7 and is largest when the resonance layer is over the detector sightline. Future experiments are proposed to extend the results obtained here.

54311 High-power testing of the folded waveguide. Haste, G.R. (Oak Ridge National Laboratory, Oak Ridge, TN (USA)); Hoffman, D.J. *AIP Conference Proceedings (American Institute of Physics) (USA),* 190(1): 266-269 (1 Jul 1989). DOE Contract AC05-84OR21400. (CONF-8905120–: 8. topical conference on radio frequency power in plasmas, Irvine, CA (USA), 1-3 May 1989).

The folded waveguide, an alternative launcher for large plasma devices, is under development at Oak Ridge National Laboratory (ORNL) using a full-scale 80-MHz model. In the folded waveguide, rf field exist over a surface area, which increases the waveguide's multipactoring susceptibility. Edges with small radii of curvature enhance the field strength and breakdown susceptibility.

54312 Measurments of ICRF fields near a model antiena. Hershkowitz, N. (University of Wisconsin-Madison, Madison, WI (USA)); Majeski, R.; Tanaka, T.; Intrator, T. *AIP Conference Proceedings (American Institute of Physics) (USA),* 190(1): 270-273 (1 Jul 1989). DOE Contract FG02-88ER53264. (CONF-8905120–: 8. topical conference on radio frequency power in plasmas, Irvine, CA (USA), 1-3 May 1989).

RF B fields are measured near the Faraday shield of a model loop antenna in a vacuum and in the presence of a plasma. The axisymmetric plasma is produced in the central cell of the Phaedrus-B tandem mirror. Results are found to be in good agreement with the predictions of the code ANTENA.

54313 ICRF heating on TFTR with the ORNL antenna. Hoffman, D.J. (Oak Ridge National Laboratory, Oak Ridge, TN (USA)); Gardner, W.L.; Ryan, P.M.; Greene, G.J.; Hosea, J.C.; Wilson, J.R.; Stevens, J.E. *AIP Conference Proceedings (American Institute of Physics) (USA),* 190(1): 274-277 (1 Jul 1989). DOE Contract AC05-84OR21400. (CONF-8905120–: 8. topical conference on radio frequency power in plasmas, Irvine, CA (USA), 1-3 May 1989).

Initial ion cyclotron range of frequencies (ICRF) heating experiments on TFTR began in the summer of 1988. Although we were in the comissioning stage for much of the equipment, some plasma coupling measurements were made in the fall. This paper is focused on the results from the Bay L antenna.

54314 ICRF antenna designs and relative performances on TFTR. Hosea, J. (TFTR Group Princeton University, Princeton, NJ (USA)); Bonanos, P.; Colestock, P.; Greene, G.; Medley, S.; Phillips, C.; Stevens, J.; Wilson, J.; Gardner, W.; Hoffman, D.; Sain, D.W. *AIP Conference Proceedings (American Institute of Physics) (USA),* 190(1): 278-281 (1 Jul 1989). DOE Contract AC02-76CH03073. (CONF-8905120–: 8. topical conference on radio frequency power in plasmas, Irvine, CA (USA), 1-3 May 1989).

Two compact antenna designs, each having two toridally separated current straps, are being used to perform high power ICRF experiments on TFTR. For the modest density regimes ($\bar{n}e \leq 3\times10^{13}$ cm^{-3}) studied in the 1988 TFTR run, the end-fed slotted-wall design delivered up to 2.8 MW (souce limited) and the off-center fed, solid-wall design delivered up to 0.6 MW (coupling/configuration limited). both antennas exhibited similar heating efficiencies which were optimum (~30% greater on average) for out-of-phase current strap excitation. In-phase strap operation of the first antenna design at relatively high power resulted in a dramatic localized sputtering of the antenna shield TiC surface, suggesting the interation of Bernstein waves with local impurity resonances. Out-of-phase operation of this design exhibited no such interaction and gave a high loading value consistent with 6 MW capability with future two-source operation even at $\bar{n}e \sim 2\times10^{13}$ cm^{-3}. Lower than expected antenna loading for the second antenna design has been found to account for the power limit which will be eased during the upcoming run period by placing this antenna closer to the plasma and further enhancing its voltage standoff capacily to extend its operation to the multimegawatt power level.

54315 ICRH in large tokamaks with poloidal magnetic field. Imre, K. (Courant Institute of Mathematical Sciences, NYU, New York, NY (USA)); Weitzner, H.; Stevens, D.C.; Batchelor, D.B. *AIP Conference Proceedings (American Institute of Physics) (USA),* 190(1): 282-285 (1 Jul 1989). DOE Contract FG02-86ER53233 ;FG02-86ER53223. (CONF-8905120–: 8. topical conference on radio frequency power in plasmas, Irvine, CA (USA), 1-3 May 1989).

The poloidal component of the equillibrium magnetic field is shown to alter fundamentally the wave propagation characteristics across ion cyclotron resonance layers. The local theory, or perpendicular stratification approximation, which ignores this field component is replaced by a nonlocal theory for which the field

equation is an integrodifferential equuation. We give a few exact general results, and sample numerical results for a typical CIT application.

54316 Examination of cathodically charged palladium electrodes for excess heat, neutron emission, or tritium production. Wiesmann, H. (Brookhaven National Lab., Dept. of Applied Science, Upton, NY (US)). *Fusion Technology (USA)*, 17(2): 350-354 (Mar 1990).

This paper presents a search for steady-state excess heat, neutron emission, or tritium production carried out for palladium electrodes electrolytically charged with deuterium. No substantial deviation in cell temperatures was observed, and the upper limit to excess heat production was 320 mW/cm^3 for the largest palladium cathode. No increase in neutron production above background levels was observed, and the sensitivity of the neutron detection system yielded an upper limit of 2.18×10^{-22} (3-σ) fusion/s · atom^{-1} pair. The tritium levels in the cells increased by 50%, but the cells were run in the open configuration and the tritium increases were consistent with electrolytic enrichment. An approximate upper limit for tritium production was 2×10^2 tritium/ml · C^{-1}. The cell temperatures were recorded once daily and monitored intermittently, but no transient excess heat excursions were observed throughout the experiment.

54317 On cold fusion. Spinrad, B.I. (Iowa State Univ., Dept. of Nuclear Engineering, Ames, IA (US)). *Fusion Technology (USA)*, 17(2): 343 (Mar 1990).

This paper argues that a high negative voltage on a metal into which deuterium is soaked might enhance fusion reactions. The author discusses how this may have been the way Fleischmann and Pons achieved their results.

54318 Sawtooth mixing effects on ICRF power deposition in tokamaks. Phillips, C.K. (Princeton Plasma Physics Laboratory, P.O. Box 451, Princeton, NJ (USA)); Cavallo, A.; Colestock, P.L.; Smithe, D.N.; Greene, G.J.; Hammett, G.W.; Hosea, J.C.; Stevens, J.E.; Wilson, J.R.; Hoffman, D.J.; Gardner, W.L. *AIP Conference Proceedings (American Institute of Physics) (USA)*, 190(1): 310-313 (1 Jul 1989). DOE Contract AC02-76CH03073. (CONF-8905120–: 8. topical conference on radio frequency power in plasmas, Irvine, CA (USA), 1-3 May 1989).

A series of experiments was performed on TFTR in which the toroidal field strength, and hence the location of the ICRF resonance layer, was varied. Electrons were heated primarily via collisions with the fast tail ions produced by the rf heating. The net power deposited to electrons on axis can be directly inferred from ECE measurements of the rate of rise of the central electron stored energy immediately following a sawtooth crash. Comparisons between these meaurements and calculations of the net central electron heating obtained using the SNARF tokamak simulation code as well as PPL's ray tracing/Fokker-Planck code implied that the predicted power deposition was too localized. Results obtained by incorporating a sawtooth mixing model for the fast ions into the deposition codes are in good agreement with the experimental measurements.

54319 High power Ion Berstein wave experiments on DIII-D. Pinsker, R.I. (General Atomics, San Diego, CA (USA)); Mayberry, M.J.; Porkolab, M.; Prater, R. *AIP Conference Proceedings (American Institute of Physics) (USA)*, 190(1): 314-317 (1 Jul 1989). DOE Contract AC03-89ER51114. (CONF-8905120–: 8. topical conference on radio frequency power in plasmas, Irvine, CA (USA), 1-3 May 1989).

Previous tokamak experiments with Ion Bernstein wave heating have exhibited efficient central ion heating and associated improvement in particle confinements. In experiments reported here central ion heating at 3/2ΩH with a small He^4 minority was observed. the transmitter frequency was 38 MHz and the nominal central toroidal field was B_T=1.8 T, which places the 3/2 Ω_H layer a few centimeters outboard of the magnetic axis, and the $2\Omega_H$ layer just behind the radiating element in the antenna. (AIP)

54320 Loading, absorption, and Fokker-Planck calculations for upcoming ICRF experimetns on ATF±. Shepard, T.D. (ORNL Fusion Energy Division, Oak Ridge, TN (USA)); Carter, M.D.; Goulding, R.H.; Kwon, M. *AIP Conference Proceedings (American Institute of Physics) (USA)*, 190(1): 334-337 (1 Jul 1989). DOE Contract AC05-84OR21400. (CONF-8905120–: 8. topical conference on radio frequency power in plasmas, Irvine, CA (USA), 1-3 May 1989).

ICRF experiments on ATF at the 100-kW level are planned for the current 1989 operating period. These plans include the $2\omega_{cH}$ regime at f_{RF}=28.88 MHz, D(H) at 14.44 MHz, and ^{4}He(^{3}He) and D(^{3}He) at 9.63 MHz. ECH target plasmas have $N_{eO} \leq 0.15 \times 10^{20}$ m^{-3} and B=0.95 T. The density and temperature profiles obtained are broader than those from 1988, owing to recent field error corrections. The values used for target-plasma parameters in the calcualtions were taken from initial 1989 ATF data. Loading and absorption calcualtins have been perofmred using the 3D RF heating code oion with a helically symmetric equilibrium, and Fokker-Planck calcualtins were performed using the steady-state code rftrans with two velocity dimensions and one spatial dimension.

54321 Metal impurity behavior during ICRF heating on TFTR. Stevens, J. (Plasma Physics Laboratory, Princeton University, Princeton, NJ (USA)); Bush, C.; Colestock, P.; Greene, G.J.; Hill, K.W.; Hosea, J.; Phillips, C.K.; Stratton, B.; vonGoeler, S.; Wilson, J.R. *AIP Conference Proceedings (American Institute of Physics) (USA)*, 190(1): 342-345 (1 Jul 1989). DOE Contract AC02-76CH03073. (CONF-8905120–: 8. topical conference on radio frequency power in plasmas, Irvine, CA (USA), 1-3 May 1989).

ICRF power levels of up to 2.8 MW were achieved during the 1988 experimental run on TFTR. The central metal impurity concentrations (Ti, Cr, Fe, Ni) and Zeff were monitored during ICRF heating by X-ray pulse height analysis and UV spectroscopy. Antenna phasing was the key variable affecting IRF performance. No increase in metalic impurities was observed for $P \lesssim 2.8$ MW with the antenna straps phased O-Π, while measureable increases in titanium (Faraday screen material) were observed for $\lesssim$1.0 MW with O-O phasing.

54322 Alcator C-Mod ICRF fast wave antenna design and analysis and expected plasma performance. Takase, Y. (MIT Plasma Fusion Center, Cambridge, MA (USA)); Golovato, S.; Porkolab, M.; Becker, H.; Diatchenko, N.; Kochan, S.; McCoy, C.; Pierce, N. *AIP Conference Proceedings (American Institute of Physics) (USA)*, 190(1): 346-349 (1 Jul 1989). DOE Contract AC02-76ET51001. (CONF-8905120–: 8. topical conference on radio frequency power in plasmas, Irvine, CA (USA), 1-3 May 1989).

The design and analysis of the fast wave antenna to be used for ICRF heating experiments on the Alcator C-Mod tokamak are described. A movable single-strap low-field-side-launch loop antenna will be used during the initial operation period. Structural analysis against disruption and thermal analysis are performed. Optimized two-strap antennae with twice the surface area are planned for high-power heating experiments. Antenna-plasma coupling studies indicate a poor (<20%) single-pass ion absorption for D(^{3}He), and a radiation resistance of $\gtrsim 10\Omega$. Minority ions are not expected to be accelerated to very high energies under typical operating densities ($T_{eff} \lesssim 50$ keV for $\bar{n}_e \gtrsim 3 \times 10^{20} m^{-3}$), and energetic ions should mainly slow down on ions. The transport of minority ions broadens the energetic minority ion and slowing down profiles and reduces T_{eff}, but the effect is small for $\bar{n}_e \gtrsim 3 \times 10^{20} m^{-3}$.

54323 Radiation force effects on magnetohydrodynamic equilibria. Tataronis, J.A. (University of Wisconsin Madison, Madison, WI (USA)). *AIP Conference Proceedings (American Institute of Physics) (USA)*, 190(1): 354-357 (1 Jul 1989). DOE Contract FG02-88ER53264. (CONF-8905120–: 8. topical conference on radio frequency power in plasmas, Irvine, CA (USA), 1-3 May 1989).

Quasi-static radiation forces, produced by ICRF waves, can modify tokamak equilibria by breaking the characteristic axisymmetry and producing magnetic island structures. The induced magnetic islands form about rational magnetic surfaces and magnetic axes of the unperturbed tokamak. In this paper, we present a perturbation analysis of a toroidal magnetohydrodynamic (MHD) plasma equilibrium that is under the influence of forces produced by low frequency waves. Conditions for magnetic island formation are derived.

54324 High-power microwave generation by excitation of a plasma-filled rippled boundary resonator. Carmel, Y. (Maryland Univ., College Park, MD (USA). Lab. for Plasma Research); Lou, W.R.; Destler, W.W.; Granatstein, V.L.; Abe, D.K.; Rodgers, J.; Minami, K.; Kens, R.A. *IEEE Transactions on Plasma Science (Institute of Electrical and Electronics Engineers) (USA),* 18(3): 497-506 (Jun 1990).

An experimental demonstration of a strong enhancement of the interaction efficiency in a high-power relativistic backward-wave oscillator when plasma is injected is presented. Controlled plasma injection enhances the interaction efficiency over the vacuum case by a factor of up to 8 to a value of about 40%. A linear theory of electromagnetic wave generation in plasma-loaded corrugated wall resonators is reviewed. A number of physical mechanisms are considered to account for the enhanced interaction, including two variations of a three-wave interaction involving the electron-beam slow space-charge wave, the slow electromagnetic waves in the structure, and the quasi-electrostatic waves in the plasma.

54325 Dependence of relativistic backward wave oscillator properties on effective beam gamma. Butler, J.M. (Cornell Univ., Ithaca, NY (USA). Lab. of Plasma Studies); Wharton, C.B.; Furukawa, S. *IEEE Transactions on Plasma Science (Institute of Electrical and Electronics Engineers) (USA),* 18(3): 490-496 (Jun 1990).

The operation of a backward wave oscillator (BWO) is shown to be critically dependent on the energy of the slow space-charge wave of the electron beam. Experimental work parameterizing the dependence of microwave frequency on effective beam energy, γ_{beam}, reveals that through an understanding of electron-beam dynamics, a BWO could be systematically tuned through a desired frequency range while maintaining a high power of a few hundred megawatts and narrow frequency bandwidth, which was 400 MHz.

54326 The interaction of high- and low-frequency waves in a free electron laser. Latham, P.E. (Maryland Univ., College Park, MD (USA). Lab. for Plasma Research); Levush, B. *IEEE Transactions on Plasma Science (Institute of Electrical and Electronics Engineers) (USA),* 18(3): 472-481 (Jun 1990).

When a free electron laser (FEL) interaction occurs inside a waveguide, there are two possible operating frequencies at the two intersections of the beam line with the waveguide dispersion curve. Using a one-dimensional model valid for a low-gain oscillator, the mode competition between the high- and low-frequency waves is studied. It is found that the low-frequency wave can be nonlinearly suppressed, even when its linear growth rate is positive. When the frequency ratio is two, phase locking occurs and the nonlinear gain of the low-frequency wave can exceed its linear growth rate.

54327 Coupled-wave theory of FEL sidebands in a waveguide. Sternbach, E.J. (Laboratoire Physique de Milieux Ionises, Ecole Polytechnique, F-91128 Palaiseau (FR)). *IEEE Transactions on Plasma Science (Institute of Electrical and Electronics Engineers) (USA),* 18(3): 460-465 (Jun 1990).

In this report, free electron laser (FEL) sidebands in waveguides are studied using a set of coupled-wave equations. Using a separate wave equation for each frequency to be studied allows one to correctly include the effects of dispersion, since each frequency evolves with a different velocity. Within the coupled-wave description, the particles and fields evolve as a set of coupled pendulums. Since more than one frequency in a waveguide can move at the same phase velocity, it is possible for additional sideband peaks to form in a waveguide. A variety of three-wave and four-wave interactions are possible, and some combinations of waves are unstable and lead to sideband growth. A dispersion analysis is performed and used to predict the sideband growth rate. This analysis agrees well with a computer simulation designed to perform FEL simulations in a dispersive waveguide.

54328 Traveling-wave-tube simulation: The IBC code. Morey, I.J. (California Univ., Berkeley, CA (USA). Dept. of Electrical Engineering and Computer Sciences); Birdsall, C.K. *IEEE Transactions on Plasma Science (Institute of Electrical and Electronics Engineers) (USA),* 18(3): 482-489 (Jun 1990).

A beam-circuit code is presented, to run interactively on fast PC's or workstations, for purposes of first-cut design of Traveling-Wave Tubes (TWT's) at small and large amplitudes. The new physics parts are the use of particle-in-cell methods to obtain the space-charge forces, and the following of the electron beam over the full length of the tube. The model is fully nonlinear and one-dimensional, with the transverse space-charge fields approximated by one mode. The slow-wave circuit is modeled by a transmission line. All variables are displayed continuously, such as the velocity displacement of all the particles (phase space), beam charge and current densities, space-charge field, circuit field, voltage and current, circuit power, and the location of the added loss. Some initial runs are presented.

54329 Plasma effects in a free electron laser. Tripathi, V.K. (Maryland Univ., College Park, MD (USA). Lab. for Plasma Research); Liu, C.S. *IEEE Transactions on Plasma Science (Institute of Electrical and Electronics Engineers) (USA),* 18(3): 466-471 (Jun 1990).

The introduction of a plasma and a strong guide magnetic field in a free electron laser (FEL) slows down the phase velocity of radiation, significantly reducing the requirements on beam energy for generating frequencies below the electron-cyclotron frequency ($\omega_1 \leq \omega_c$). Around plasma resonance $\omega_1 \sim \omega_p$, the FEL mode couples to two-stream instability (TSI), attaining a large growth rate, comparable to that of the wiggler-free TSI. At plasma densities comparable to beam density, the beam-induced local depression in the electron density of the plasma acts as a waveguide for guiding any high-frequency radiation when the beam current is $I_b \gtrsim 17$ kA.

54330 Growth and frequency pushing effects in relativistic magnetron phase-locking. Chen, S.C. (Massachusetts Inst. of Tech., Cambridge, MA (USA). Plasma Fusion Center). *IEEE Transactions on Plasma Science (Institute of Electrical and Electronics Engineers) (USA),* 18(3): 570-576 (Jun 1990).

A magnetron-specific phase-locking model has been developed using the standard equivalent-circuit approach, which takes into account the unconventional magnetron growth characteristics as well as the frequency pushing effect. These effects owe their origin to the highly nonlinear electron-wave interaction; thus they are believed to be more pronounced in relativistic magnetrons. The model predicts a wider locking-bandwidth and a shorter locking time than those in conventional locking theory. The phase-locked amplitude resonance occurs, as the results indicate, at an injection frequency different from that of the free-running oscillator.

54331 Relativistic klystron amplifiers driven by modulated intense relativistic electron beams. Lau, Y.Y. (Plasma Physics Div., U.S. Naval Research Lab., Washington, DC (US)); Friedman, M.; Krall, J.; Serlin, V. *IEEE Transactions on Plasma Science (Institute of Electrical and Electronics Engineers) (USA),* 18(3): 553-569 (Jun 1990).

An overview is provided for the novel relativistic klystron amplifiers. These amplifiers are driven by an annular intense relativistic electron beam (500-kV, 10-ka range) which is modulated by an external RF source (1.2-GHz, 100-kw range). Experiments, theory, simulation, and simple models are presented to illustrate the unusual properties of such devices which result from the intense space charge of the beam. Chief among them are electrostatic insulation against vacuum breakdown at high power levels, efficient current modulation, short bunching length, and amplitude and phase stability of the output signal.

54332 A high-power, traveling wave tube amplifier. Shiffler, D. (Cornell Univ., Ithaca, NY (USA). Lab. of Plasma Studies); Nation, J.A.; Kerslick, G.S. *IEEE Transactions on Plasma Science (Institute of Electrical and Electronics Engineers) (USA),* 18(3): 546-552 (Jun 1990).

High-power X-band traveling wave tube amplifiers (TWT's) have been fabricated and tested. The tubes have gains ranging from 13 to 35 dB at 8.76 GHz and output powers ranging from 3 to 100 MW. The amplifiers are driven by the interaction of a slow space-charge wave, propagating on an electron beam, with an electromagnetic wave supported by the structure. The electron beam, which is produced from a magnetic-field-immersed field-emission cathode, has an energy of 850 keV, a current in the 1-kA

range, and a pulse duration of 100 ns. The amplifiers are designed to operate as narrow-band devices in the TM_{01} mode. In this paper the authors report on the amplifier characteristics and compare their performance with those calculated using conventional TWT theory. The scaling of the gain and bandwidth with the beam current are approximately as expected from theory, but the absolute magnitude of the gain is somewhat greater than expected.

54333 Cyclotron-Cherenkov and Cherenkov instabilities. Kho, T.H. (California Univ., Los Angeles, CA (USA). Dept. of Physics); Lin, A.T. *IEEE Transactions on Plasma Science (Institute of Electrical and Electronics Engineers) (USA),* 18(3): 513-517 (Jun 1990).

The effect of the conventional Cherenkov instability on the cyclotron-Cherenkov maser is investigated for the case of a relativistic electron beam propagating along a background magnetic field in a dielectric using particle simulations. Both Cherenkov and cyclotron-Cherenkov instabilities are excited when the phase velocity of light in the dielectric is less than the beam velocity. It is demonstrated in the high-power regime, where the cyclotron-Cherenkov mode has the higher growth rate, that the Cherenkov mode has little effect on the nonlinear efficiency of the cyclotron-Cherenkov mode. High efficiency is possible, affirming previous predictions based on single mode calculations. The effect of beam momentum spread is studied.

54334 High-power dielectric Cherenkov maser oscillator experiments. Main, W. (Maryland Univ., College Park, MD (USA). Lab. for Plasma Research); Cherry, R.; Garate, E. *IEEE Transactions on Plasma Science (Institute of Electrical and Electronics Engineers) (USA),* 18(3): 507-512 (Jun 1990).

This paper presents the results of a series of experiments conducted on the dielectric Cherenkov maser (DCM) oscillator. The device consists of a cylindrical metallic waveguide of inner radius 3.64 cm which is partially filled with a dielectric liner. Traveling through the lined waveguide is an annular relativistic electron beam. Liners of dielectric constant $\epsilon = 10$, 5 and 2.3 were investigated for liner thicknesses of 4 and 6 mm. The 6-mm-thick, $\epsilon = 10$ liner generated an RF output of 200 MW for 20 ns at 3.8 Hz with electron-beam parameters of 700 kV, 12 kA, and pulse duration of 100 ns. The maximum measured power output for the other configurations was 80 MW at a frequency of 7 GHz ($\epsilon = 5$), with several MW of power output from the polyethylene liner ($\epsilon = 2.3$) at a frequency of $\sim$ 9 GHz.

54335 Linear theory of electromagnetic wave generation in a plasma-loaded corrugated-wall resonator. Minami, K. (Maryland Univ., College Park, MD (USA). Lab. for Plasma Research); Carmel, Y.; Granatstein, V.L.; Destler, W.W.; Kens, R.A.; Lou, W.R.; Abe, D.K.; Ali, M.M.; Hosokawa, T.; Ogura, K.; Watanabe, T. *IEEE Transactions on Plasma Science (Institute of Electrical and Electronics Engineers) (USA),* 18(3): 537-545 (Jun 1990).

A linear theory of the excitation of electromagnetic waves in a plasma-filled corrugated-wall waveguide with an arbitrarily large sinusoidal corrugation has been derived and analyzed numerically. The theory predicts that, when driven by an electron beam, the presence of a plasma in the slow wave structure will cause an increase in the oscillation frequency, and that the temporal growth rates of a high-frequency mode approach those of fundamental mode for high plasma densities. The latter result may account for the high-frequency modes observed in the authors' plasma-filled backward-wave oscillator.

54336 Phase-stability analysis of the magnetron-driven vircator experiment. Price, D. (Physics International Co., San Leandro, CA (USA)); Sze, H.M. *IEEE Transactions on Plasma Science (Institute of Electrical and Electronics Engineers) (USA),* 18(3): 580-585 (Jun 1990).

A slow envelope approximate solution to the van der Pol equation is evaluated as a model for a driven high-power oscillator experiment. It is shown that Adler's inequality gives a necessary but not sufficient condition to achieve phase-locking between the driving relativistic magnetron and the driven high-power cavity vircator oscillations. The amplitude of the entrained (phase-locked) oscillations is found as a function of the injected magnetron power, the initial frequency detuning, and other system parameters. The stability of these oscillations is examined. Not all entrained states are stable. Parametric boundaries between stable and unstable states are given. Combination oscillations containing both magnetron and circator frequency components are predicted and observed to occur when the initial detuning between the two sources is too large to allow entrainment.

54337 A reproducible rep-rate high-power magnetron microwave tube. Phelps, P.A. (General Atomics Co., San Diego, CA (USA)). *IEEE Transactions on Plasma Science (Institute of Electrical and Electronics Engineers) (USA),* 18(3): 577-579 (Jun 1990).

Observations are reported of the reproducible operation of an intense relativistic electron beam-driven high-pulsed power magnetron microwave tube at rep-rates of 1 Hz. These are the first observations of reproducible rep-rate high power magnetron, and microwave tubes in general, under several specific conditions: Ultra high vacuum; with a compact tunable modulator; and using extraction into the TE_{10} mode with radiates a polarized pencil beam. The experiments were performed in the 2 π mode. Power levels approaching 300 MW were achieved in short pulses (less than 100 ns).

54338 Temperal study of long-pulse relativistic magnetron operation. Treado, T.A. (Varian Associates, Beverly, MA (USA). Bomac Div.); Smith, R.S.; Shaughnessy, C.S.; Thomas, G.E. *IEEE Transactions on Plasma Science (Institute of Electrical and Electronics Engineers) (USA),* 18(3): 594-602 (Jun 1990).

Observations are made using a streak camera of apparent plasma motion in the interaction space of an A6 relativistic magnetron with an explosive emission cathode. The anode plasma luminosity velocity was measured to be 0.8 cm/μs, comparable with the gap closure velocity which was indirectly measured to be 1.0-1.6 cm/μs, dependent upon the magnetic field. The gap closure velocity appeared to be independent of the microwave oscillation. Long-pulse operation (hundreds of nanoseconds) as a function of the magnetron-modulator interaction is also presented. At 250 kV the A6 emitted microwave pulses, with peak powers up to 90 MW, out of a single resonator for up to 250 ns in duration, with a characteristic single-spike pulse length of 150 ns.

54339 Relativistic magnetron development for use in a lightweight, repetitively pulsed, portable HPM transmitter. Spang, S.T. (AAI Corp., Hunt Valley, MD (USA)); Anderson, D.E.; Busby, K.O.; Claborn, K.D.; Manning, S.P.; Milakovic, A.K.; Prochazka, J.J.; Rexroad, D.M.; Scannell, E.P.; Seybold, T.K.; Williams, R.J. *IEEE Transactions on Plasma Science (Institute of Electrical and Electronics Engineers) (USA),* 18(3): 586-593 (Jun 1990).

The design and development of a relativistic magnetron for use on a portable, repetitively pulsed HPM transmitter is described. Operation of the magnetron at peak power levels of 700 MW, efficiencies of 15%, pulse widths up to 50 ns, output energies of 15 J, and repetition rates of 2 Hz is described. Frequency variation of the magnetron by varying the cathode radius is described and frequency change during the magnetron pulse is analyzed. Practical system design considerations such as integration, lifetime, reliability, and reproducibility are discussed.

54340 Potential high-Q, noninductive current drive in tokamaks via accelerated compact toroids. Ho, S.K. (Lawrence Livermore National Lab., CA (USA)); Perkins, L.J.; Hammer, J.H. *Fusion Technology (USA),* 17(4): 658-660 (Jul 1990). DOE Contract W-7405-ENG-48.

The possibility of applying compact toroids (CTs) to drive current via helicity injection in an engineering test reactor tokamak is considered. Some preliminary calculations for the International Thermonuclear Experimental Reactor are presented and it is shown that plasma gain Q values (i.e., fusion power/injected CT power) in an unoptimized system may be of the order of 10 to 40, depending on the CT/tokamak interaction processes.

54341 Numerical simulations of a relativistic magnetron. Weatherall, J.C. (Pomona Div., General Dynamics, Pomona, CA (US)). *IEEE Transactions on Plasma Science (Institute of Electrical and Electronics Engineers) (USA),* 18(3): 603-610 (Jun 1990).

A two-dimensional particle-in-cell (PIC) simulation is used to study the self-consistent evolution of the space-charge cloud in a

high-power magnetron. In the simulation, a rotating reference frame reduces the field solution to an inversion of Poisson's equation, which is solved in a cylindrical geometry. The particles are moved relativistically. The simulation is applied to the A6 magnetron, which is the prototype for the new class of relativistic magnetrons. Good agreement is found with published experimental results. The simulation is used to study the effect of power extraction on efficiency, the role of the wave magnetic field on saturation, and relativistic effects on magnetron operation. Interaction regions within the charge cloud are identified.

54342 The reflex-diode HPM source on Aurora. Huttlin, G.A. (Harry Diamond Labs., Adelphi, MD (USA)); Bushell, M.S.; Conrad, D.B.; Davis, D.P.; Litz, M.S.; Ruth, B.G.; Agee, F.J.; Ebersole, K.L.; Judy, D.C.; Lezcano, P.A.; Pereira, N.R.; Weidenheimer, D.M. *IEEE Transactions on Plasma Science (Institute of Electrical and Electronics Engineers) (USA)*, 18(3): 618-625 (Jun 1990).

This paper describes the most recent in a series of experiments to develop the reflex diode as a source of microwaves on the Aurora relativistic electron-beam pulser. The authors have achieved an overall output for radial extraction of ~ 400 J in microwave bursts from ~ 100 to 150 ns at frequencies below 1 GHz. The diagnostics for radial extraction have included directional couplers, card calorimeters, and free-field sensors. The authors have varied the anode/cathode spacing, downstream microwave reflector, and a second anode foil, but, within the range of variations, no strong trends have been noted.

54343 Enhanced-efficiency, narrow-band gigawatt microwave output of the reditron oscillator. Davis, H.A. (Los Alamos National Lab., NM (USA)); Fulton, R.D.; Sherwood, E.G.; Kwan, T.J.T. *IEEE Transactions on Plasma Science (Institute of Electrical and Electronics Engineers) (USA)*, 18(3): 611-617 (Jun 1990). DOE Contract W-7405-ENG-36.

The authors describe experiments which confirm theoretical predictions of higher efficiency, narrower bandwidth microwave output of the reditron oscillator over simple vircator high-power microwave devices. They have produced 1.6 GW of microwave power at 2.46 GHZ. The conversion efficiency from beam power to microwave power was 5.5 to 6%, exceeding the usual 1 to 3% efficiency obtained with conventional vircators. The 1% bandwidth was about a factor of 10 less than the usual value for virtual cathode oscillators. The authors present computer calculations of the experiment that are in reasonable agreement with the experimental findings.

54344 An omegatron mass spectrometer for plasma ion species analysis. Wang, E.Y. (Institute of Plasma and Fusion Research, (USA)); Schmitz, L.; Ra, Y.; LaBombard, B.; Conn, R.W. *Review of Scientific Instruments (USA)*, 61(8): 2155-2158 (Aug 1990). DOE Contract AS03-84ER52104.

An omegatron mass spectrometer which can be used to measure the ion species and charge state distribution in a magnetized plasma is described. In the conventional omegatron, ions are formed as the result of gas ionization by a fine electron beam passing through the center of the analyzer along the magnetic field. In the plasma omegatron, the plasma ions are entering the analyzer through a small floating aperture. We employ a biasing technique to reduce the ion velocity along the magnetic field and, thus, achieve improved ion collection and sensitivity. Experiments have been performed to demonstrate the instrument's operation in the PISCES-A linear plasma device, at a magnetic field B=1.3 kG. Mass spectra have been obtained in hydrogen, helium, and nitrogen plasmas, and typical results are presented.

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Refer also to citation(s) 53196, 53310, 53311, 53456, 53480, 53948, 54077, 54090, 54273, 54274, 54284, 54289, 54290, 54294, 54297, 54298, 54316, 54317, 54324, 54325, 54327, 54328, 54330, 54331, 54332, 54334, 54336, 54337, 54338, 54340, 54341, 54342

54345 (CEA-CONF–10081) **Compatibility problems in tritium breeding blankets.** Broc, M.; Flament, T.; Terlain, A.; Sannier, J. CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Chimie Appliquee et d'Etudes Analytiques. 1989. 19p. (CONF-891204–: 4. international conference on fusion reactor materials, Kyoto (Japan), 4-8 Dec 1989). Order Number DE91716200. Source: NTIS (US Sales Only), PC A03/MF A01.

Compatibility between tritium breeding materials (liquid or solid), neutron multiplier and structural steels is a concern for the choice of a tritium breeding blanket for NET. For solid tritium breeding blanket, it seems that the more severe compatibility problem is due to the interaction of beryllium with steel. As for the water-cooled Pb17Li blanket, the first results obtained in experimental conditions closed to the concept have evidenced lower corrosion rates than those measured in thermal convection loops.

54346 (CEA-CONF–10210) **Diagnostics of experiments on laser implosion targets at CEL-V.** Schirmann, D. (CEA Centre d'Etudes de Limeil, 94 - Villeneuve-Saint-Georges (France)); Bocher, J.L.; Bourgade, J.L.; Decroisette, M.; Garconnet, J.P.; Juraszek, O.; Mens, A.; Sauneuf, R.; Thiell, G.; Bertin, A.; Grenier, G. CEA Centre d'Etudes de Limeil, 94 - Villeneuve-Saint-Georges (France). 1990. 28p. (CONF-9001121–: 20. European Conference on Laser Interaction with Matter, Schliersee, DE (USA), 22-26 Jan 1990). Order Number DE91716203. Source: NTIS (US Sales Only), PC A03/MF A01.

Numerous diagnostics have been implemented on Phebus, to carry out the basic measurements for interaction and implosion studies. An important package is devoted to characterize the plasma emission in the X-UV and soft X-ray ranges. Other complementary diagnostics have been developed to measure the performance of an ablative implosion: the fuel and the pusher are respectively determined by knock-on and radiochemistry methods.

54347 (CNIC–00289) **Development and application of superconducting magnet for gyrotron with 4 mm wave length.** Zhu Xuewu (Southwest Inst. of Physics, Leshan, SC (China)); Pu Men; Chen Jian; Liu Jianmin; Shi Qingju. China Nuclear Information Centre, Beijing, BJ (China). Jan 1989. 7p. (In Chinese). (SIP–0032). Order Number DE91605257. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

A superconducting magnet for gyrotron with 4 mm wave legnth is developed, its main magnetic field reaches 3 T. The gyrotron combined with the magnet producesfundamental wave long pulse, its power is more than 60 kW, pulse duration 10 ≈ 20 ms, frequency 70 GHz. It is used for plasma preionization experiment on HL-1 Tokamak.

54348 (CONF-901007–18) **ITER helium ash accumulation.** Hogan, J.T. (Oak Ridge National Lab., TN (USA)); Hillis, D.L.; Galambos, J.; Uckan, N.A.; Dippel, K.H.; Finken, K.H.; Hulse, R.A.; Budny, R.V. Oak Ridge National Lab., TN (USA). [1990]. 8p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From 9. topical meeting on technology of fusion energy; Oak Brook, IL (USA); 7-11 Oct 1990. Order Number DE91001487. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

Many studies have shown the importance of the ratio υ_{He}/υ_E in determining the level of He ash accumulation in future reactor systems. Results of the first tokamak He removal experiments have been analysed, and a first estimate of the ratio υ_{He}/υ_E to be expected for future reactor systems has been made. The experiments were carried out for neutral beam heated plasmas in the TEXTOR tokamak, at KFA/Julich. Helium was injected both as a short puff and continuously, and subsequently extracted with the Advanced Limiter Test-II pump limiter. The rate at which the He density decays has been determined with absolutely calibrated charge exchange spectroscopy, and compared with theoretical models, using the Multiple Impurity Species Transport (MIST) code. An analysis of energy confinement has been made with PPPL TRANSP code, to distinguish beam from thermal confinement, especially for low density cases. The ALT-II pump limiter system is found to exhaust the He with maximum exhaust efficiency (8 pumps) of ~8%. We find $1<\upsilon_{He}/\upsilon_E<3.3$ for the database of cases analysed to date. Analysis with the ITER TETRA systems code shows that these values would be adequate to achieve the required He concentration with the present ITER divertor He extraction system.

54349 (CONF-901035–7) **Energetic particle induced desorption of water vapor cryo-condensate.** Menon, M.M.; Owen, L.W.; Simpkins, J.E.; Uckan, T.; Mioduszewski, P.K. Oak Ridge

National Lab., TN (USA). [1990]. 17p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From 37. national American Vacuum Society symposium; Toronto (Canada); 8-12 Oct 1990. Order Number DE91001255. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

An in-vessel cryo-condensation pump is being designed for the Advanced Divertor configuration of the DIII-D tokamak. To assess the importance of possible desorption of water vapor from the cryogenic surfaces of the pump due to impingement of energetic particles from the plasma, a 77 K surface on which a thin layer of water vapor was condensed was exposed to a tenuous plasma (density = 2×10^{10} cm^{-3}, electron temperature = 3 eV). Significant desorption of the condensate occurred, suggesting that impingement of energeticparticles (10 eV) at flux levels of $\sim 10^{16}$ $cm^{2}s^{-1}$ on cryogenic surfaces could potentially induce impurity problems in the tokamak plasma. A pumping configuration is presented in which this problem is minimized without sacrificing the pumping speed.

54350 (DOE/DP/40200–132) **LLE [Laboratory for Laser Energetics] review: Quarterly report, April–June 1990.** Kumpan, S.A. (ed.). Rochester Univ., NY (USA). Lab. for Laser Energetics. [1990]. 72p. Sponsored by U.S. DOE Defense Programs. DOE Contract FC03-85DP40200. Order Number DE91001254. Source: NTIS, PC A04/MF A01 - OSTI; GPO Dep.

This volume of the LLE Review, covering the period April–June 1990, contains articles in two main sections, Progress in Laser Fusion and Advanced Technology Developments. The first article presents the theoretical interpretation of the glass-ablator cryogenic-implosion experiments recently conducted on OMEGA. It is followed by an article describing the analysis of neutron time-of-flight data taken during DT and DD experiments; and a discussion of the improvements to laser diagnostics that now provide for precise control of the OMEGA laser is given. This paper contains a report on the development of transparent conductive coatings for KDP crystals, and a discussion of the study of the transient-surface Debye-Waller effect in materials irradiated with an ultrafast laser.

54351 (DOE/ER–0313/8) **Fusion reactor materials semiannual progress report for the period ending March 31, 1990.** Oak Ridge National Lab., TN (USA). Aug 1990. 299p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. (ORNL/M–1225). Order Number DE91000523. Source: NTIS, PC A13/MF A01; OSTI; INIS; GPO Dep.

This report mainly discusses topics on the physical effects of radiation on thermonuclear reactor materials. The areas discussed are: irradiation facilities, test matrices, and experimental methods; dosimetry, damage parameters, and activation calculations; fundamental mechanical behavior; radiation effects; mechanistic studies, theory and modeling; development of structural alloys; solid breeding materials; and ceramics. (FI)

54352 (DOE/ET/51013–285) **Fatigue, fracture, and life prediction criteria for composite materials in magnets.** Wong, F.M.G. Massachusetts Inst. of Tech., Cambridge, MA (USA). Plasma Fusion Center. Jun 1990. 179p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-78ET51013. (PFC/RR–90-10). Order Number DE91001663. Source: NTIS, PC A09/MF A01; OSTI; INIS; GPO Dep.

An explosively-bonded copper/Inconel 718/copper laminate conductor was proposed to withstand the severe face compression stresses in the central core of the Alcator C-MOD tokamak toroidal field (TF) magnet. Due to the severe duty of the TF magnet, it is critical that an accurate estimate of useful life be determined. As part of the effort to formulate an appropriate life prediction, fatigue crack growth experiments were performed on the laminate as well as its components. Metallographic evaluation of the laminate interface revealed many shear bands in the Inconel 718. Shear bands and shear band cracks were produced in the Inconel 718 as a result of the explosion bonding process. These shear bands were shown to have a detrimental effect on the crack growth behavior of the laminate, by significantly reducing the load carrying capability of the reinforcement layer and providing for easy crack propagation paths. Fatigue crack growth rate was found not only to be dependent on temperature but also on orientation. Fatigue cracks grew faster in directions which contained shear bands in the plane of the propagating crack. Fractography showed crack advancement by fatigue cracking in the Inconel 718 and ductile tearing of the copper at the interface. However, further away from the interfaces, the copper exhibited fatigue striations indicating that cracks were now propagating by fatigue. Laminate life prediction results showed a strong dependence on shear band orientation, and exhibited little variation between room temperature and 77°K. Predicted life of this laminate was lower when the crack propagation was along a shear band than when crack propagation was across the shear bands. Shear bands appear to have a dominating effect on crack growth behavior.

54353 (DOE/ET/51013–T231) **A method for estimating tokamak poloidal field coil currents which incorporates engineering constraints.** Stewart, W.A. Massachusetts Inst. of Tech., Cambridge, MA (USA). Plasma Fusion Center. May 1990. 147p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-78ET51013. (PFC/RR–90-8). Order Number DE91001662. Source: NTIS, PC A07/MF A01; OSTI; INIS; GPO Dep.

This thesis describes the development of a design tool for the poloidal field magnet system of a tokamak. Specifically, an existing program for determining the poloidal field coil currents has been modified to: support the general case of asymmetric equilibria and coil sets, determine the coil currents subject to constraints on the maximum values of those currents, and determine the coil currents subject to limits on the forces those coils may carry. The equations representing the current limits and coil force limits are derived and an algorithm based on Newton's method is developed to determine a set of coil currents which satisfies those limits. The resulting program allows the designer to quickly determine whether or not a given coil set is capable of supporting a given equilibrium. 25 refs.

54354 (GA-A–20219) **DIII-D results and plans.** Callis, R.; Anderson, P.; Colleraine, A.; Smith, J.; Petersen, P.; Taylor, P. General Atomics, San Diego, CA (USA). Sep 1990. 7p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-89ER51114. (CONF-900918–13: 16. symposium on fusion technology, London (UK), 3-7 Sep 1990). Order Number DE91001548. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

The completion of additional radiation shielding in the spring of 1989 has allowed the DIII-D tokamak to enter a new phase of experimental operation, in which the potential of injecting deuterium beam injection into deuterium plasmas has been exploited. The benefit of the isotope effect in increased energy confinement time, and increased power delivery by the neutral beam injectors, has been used to extend the machine performance. Plasma beta values ($\beta_T \leq 10.7\%$) near expected theoretical limits (3.5 I/aB) have been obtained and high energy content discharges with $\beta_T = 5.2\%$ have been achieved at full magnetic field (2.1 T). The stored energy has reached 3.6 MJ and diverted plasmas with 3 MA have been produced. Enhanced (H-mode) energy confinement plasmas have been maintained for over 10 seconds with no indication of impurity accumulation. This paper presents a brief description of the shielding design; a discussion of the performance improvements of the neutral beam ion sources with deuterium; an overall review of plasma parameters achieved recently in the DIII-D tokamak; and a presentation of new hardware systems being brought on line (e.g. Advanced Divertor, Fast Wave Current Drive, and 110 GHz ECH). 9 refs., 4 figs., 1 tab.

54355 (GA-A–20231) **2 MW 110 GHz ECH heating system for DIII-D.** Moeller, C.; Prater, R.; Callis, R.; Remsen, D.; Doane, J.; Cary, W.; Phelps, R.; Tupper, M. General Atomics, San Diego, CA (USA). Sep 1990. 5p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-89ER51114. (CONF-900918–12: 16. symposium on fusion technology, London (UK), 3-7 Sep 1990). Order Number DE91001357. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

A 2 MW 110 GHz ECH system using Varian 0.5 MW gyrotrons is under construction for use on the DIII-D tokamak by late 1991. Most of the components are being design and fabricated at General Atomics, including the gyrotron tanks, superconducting magnets, and transmission line. These components are intended for operation with 10 second pulses and, in the future, with 1 MW gyrotrons. 6 refs., 5 figs.

54356 (GA-A–20238) **Vertical stability, high elongation, and the consequences of loss of vertical control on DIII-D.** Kellman, A.G. (General Atomics, San Diego, CA (USA)); Ferron, J.R.; Jensen, T.H.; Lao, L.L.; Luxon, J.L.; Skinner, D.G.; Strait, E.J.; Reis, E.; Taylor, T.S.; Turnbull, A.D.; Lazarus, E.A.; Lister, J.B. General Atomics, San Diego, CA (USA). Sep 1990. 6p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-89ER51114. (CONF-900918–10: 16. symposium on fusion technology, London (UK), 3-7 Sep 1990). Order Number DE91001324. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

Recent modifications to the vertical control system for DIII-D has enabled operation of discharges with vertical elongation κ, up to 2.5. When vertical stability is lost, a disruption follows and a large vertical force on the vacuum vessel is observed. The loss of plasma energy begins when the edge safety factor q is 2 but the current decay does not begin until q ~1.3. Current flow on the open field lines in the plasma scrapeoff layer has been measured and the magnitude and distribution of these currents can explain the observed force on the vessel. Equilibrium calculations and simulation of this vertical displacement episode are presented. 7 refs., 4 figs.

54357 (GA-A–20239) **Results of tests of the X2274 high power tetrode in a JT-60 110 to 130 MHz ICRH amplifier.** Remsen, D.B. (General Atomics, San Diego, CA (USA)); Loring, C.M.; McNees, S.G.; Moriyama, S.; Ogawa, Y.; Anno, K.; Fujii, T.; Terakado, M.; Kogure, S.; Nagashima, T.; Ohta, M. General Atomics, San Diego, CA (USA). Sep 1990. 6p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-89ER51114. (CONF-900918–11: 16. symposium on fusion technology, London (UK), 3-7 Sep 1990). Order Number DE91001325. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

This paper reports the results of tests of the newly developed Varian EIMAC X2274 in the JAERI JT-60 ICRH system at pulse lengths up to 6 seconds at 131 MHz. It is our belief that these tests achieved the highest long pulse, or CW, power that has ever been delivered by a single power grid tube at frequencies above 100 MHz. Varian's EIMAC X2274, developed in conjunction with General Atomics and the US Department of Energy, uses an improved pyrolytic graphite grid configuration which provides significantly better vhf performance than the grids of the X2242 tetrode which was tested in this system in 1989. The EIMAC X2274 combines the improved grids with a new anode design which reduces the required water flow approximately 50% and increases the maximum anode dissipation 80%. All tests were performed at 131 MHz, the system's highest operating frequency. Tests of both prototype EIMAC X2274s produced essentially identical results. The basic objectives of these tests were: to demonstrate that the system with the EIMAC X2274 can reliably produce 1.5 MW at 130 MHz at 5 second pulse lengths for the JT-60U tokamak and to collect data for use in the design of future high power ICRH systems. In these tests the tube and system produced up to 1.7 MW at pulse lengths up to 5.4 seconds: i.e, the EIMAC X2274 in this system can easily meet Objective 1. The remainder of this paper shows that Objective 2 has been fulfilled. In addition to the high power tests, operational range tests were performed under variable VSWR conditions. Unlike the EIMAC X2242 tests were rf current heating of the screen grid limited output power, system parameters, rather than tube parameters, limited the output power in the high power tests. Operational range tests were conducted at output power levels chosen to be well within the system's anode cooling capability.

54358 (GA-A–20250) **Wall conditioning and plasma surface interactions in DIII-D.** Jackson, G.L. (General Atomics, San Diego, CA (USA)); Petersen, P.I.; Schaffer, M.S.; Taylor, P.L.; Taylor, T.S.; Doyle, B.L.; Walsh, D.S.; Hill, D.N.; Hsu, W.L.; Winter, J. General Atomics, San Diego, CA (USA). Sep 1990. 5p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-89ER51114. (CONF-900918–14: 16. symposium on fusion technology, London (UK), 3-7 Sep 1990). Order Number DE91001547. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

Wall conditioning is used in DIII-D for both reduction of impurity influxes and particle control. The methods used include: baking, pulsed discharge cleaning, hydrogen glow cleaning, helium and neon glow conditioning, and carbonization. Helium glow wall conditioning applied before every tokamak discharge has been effective in impurity removal and particle control and has significantly expanded the parameter space in which DIII-D operates to include limiter and ohmic H-mode discharges and higher β_T at low q. The highest values of divertor plasma current (3.0 MA) and stored energy (3.6 MJ) and peaked density profiles in H-mode discharges have been observed after carbonization. Divertor physics studies in DIII-D include sweeping the X-point to reduce peak heat loads, measurement of particle and heat fluxes in the divertor region, and erosion studies. The DIII-D Advanced Divertor has been installed and bias and baffle experiments will begin in the fall of 1991. 15 refs., 4 figs.

54359 (IEN-DEFI–1/90) **Neutron and gamma measurements during experiments in search for cold fusion.** Silva, A.G. da (Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Fisica); Auler, L.T.; Suita, J.C. Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Jan 1990. 16p. (In Portuguese). Order Number DE91605247. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

In this paper, are described the experiments performed at Instituto de Engenharia Nuclear in the Laboratorio de Engenharia Biomedica COPPE/UFRJ, during electrolysis of D_2O with paladium cathode, with the aim of reproducing the nuclear effects related by Fleischman and Pons. The results of various measurements were inconclusive with respect to neutron or gamma production due to electrolysis, and negative to energy production. (A.C.A.S.).

54360 (LBL–29370) **Design considerations for multilayer coated Schwarzschild objectives for the XUV.** Kortright, J.B.; Underwood, J.H. Lawrence Berkeley Lab., CA (USA). Jul 1990. 9p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-900756–46: SPIE's international symposium on optical and optoelectronic applied science and engineering exhibit, San Diego, CA (USA), 8-13 Jul 1990). Order Number DE91000247. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The performance of multilayer-coated Schwarzschild objectives, and similar near normal incidence soft x-ray focussing systems, can be affected by the changing angles of incidence for different rays and possible variations in multilayer period across the curved mirror surfaces. A design analysis which considers these issues is presented, using as an example a 20 times demagnifying Schwarzschild objective coated with molybdenum/silicon multilayers for operation at roughly 76 eV. The large bandwidth of these multilayers eases requirements on control of the variation of the d-spacing for the systems considered. Implications for extension to similar systems operating with different magnifications, sizes, and photon energies are discussed. 12 refs., 5 figs.

54361 (NEANDC–259-U, pp. 29-40) **Activation cross-sections for safety and environmental assessments of fusion reactors.** Cheng, E.T. (General Atomics San Diego, CA (US)). Nuclear Energy Agency, 75 - Paris (France). 1990. (CONF-890982–: Specialists' meeting on neutron activation cross sections for fission and fusion energy applications, Argonne, IL (USA), 13-15 Sep 1989). In *Proceedings of a specialists' meeting on neutron activation cross sections for fission and fusion energy applications.* 351p. Order Number DE91716261. Source: NTIS (US Sales Only), PC A16/MF A01.

The deuterium-tritium fueled fusion reaction does not directly produce radioactive products. Radioactivity in fusion is induced by the 14 MeV neutrons. Hence activation products and levels of activity in fusion reactors depend primarily on materials, neutron wall loading, and operating times. Safety and environmental aspects of fusion reactors are determined by radioactivity induced characteristics: decay heat, biological hazard potential, dose rate, and waste disposal rating. In this paper the important activation cross sections are identified that are relevant to determination of the above quantities for potential fusion reactor materials.

54362 (NEANDC–259-U, pp. 41-48) **European activation library for fusion reactor technology.** Kopecky, J. (Netherlands Energy Research Foundation Petten, (NL)); Gruppelaar, H. Nuclear Energy Agency, 75 - Paris (France). 1990. (CONF-890982–: Specialists' meeting on neutron activation cross sections for fission and fusion energy applications, Argonne, IL (USA), 13-15 Sep 1989). In *Proceedings of a specialists' meeting on neutron activation cross*

sections for fission and fusion energy applications. 351p. Order Number DE91716261. Source: NTIS (US Sales Only), PC A16/MF A01.

This paper describes the work performed to revise and extend the REAC-ECN data files, which will result in the European Activation File (EAF-1). This project is part of the European Fusion Technology Program.

54363 (NEANDC–259-U, pp. 49-63) **An one-groupe averaged cross-section benchmark for fusion activation studies.** Sublet, J.C. (UKAEA Culham Lab. Abingdon, (UK)); Mann, F.M.; Goddard, A.J.H. Nuclear Energy Agency, 75 - Paris (France). 1990. (CONF-890982–: Specialists' meeting on neutron activation cross sections for fission and fusion energy applications, Argonne, IL (USA), 13-15 Sep 1989). In *Proceedings of a specialists' meeting on neutron activation cross sections for fission and fusion energy applications.* 351p. Order Number DE91716261. Source: NTIS (US Sales Only), PC A16/MF A01.

D-T plasmas are strong sources of 14 MeV neutrons, which are transmitted through the different components of the fusion reactor. During this process they induce activity by transmutation reactions in the structural materials. Two different computer code systems for predicting induced activation and transmutation reactions have been implemented with the same input data in order to compare their predictions. The computer codes and their associated data libraries are: FISPACT/UKACTI and REAC2/REAC. The main features investigated in this benchmark exercise are the pointwise cross-section library and the resultant one-group averaged cross-section library. The condensed library includes cross-sections for each possible reaction for each nuclide. The neutron spectrum used is derived from Monte Carlo neutron transport calculations for the first wall of the Joint European Torus. Cobalt-60 and Silver-108m will dominate the radiation exposure inside the decommissioned device and therefore this benchmark concentrates on the cross-sections involved in their production from the following elements: Fe, Co, Ni, Cu and Ag.

54364 (NEANDC–259-U, pp. 73-84) **A program on neutron activation cross section measurements at FNS for fusion applications.** Ikeda, Y. (Japan Atomic Energy Research Inst. Tokai, Ibaraki (JP). Dept. of Reactor Engineering); Konno, C. Nuclear Energy Agency, 75 - Paris (France). 1990. (CONF-890982–: Specialists' meeting on neutron activation cross sections for fission and fusion energy applications, Argonne, IL (USA), 13-15 Sep 1989). In *Proceedings of a specialists' meeting on neutron activation cross sections for fission and fusion energy applications.* 351p. Order Number DE91716261. Source: NTIS (US Sales Only), PC A16/MF A01.

This paper describes the present status of an ongoing program on systematic measurements of neutron activation cross sections at the fusion neutronics source (FNS). Updated systematic trends for the specific reaction cross sections at 14.5 MeV are shown. A current focus is placed on the Long-lived activation measurement which is in part in a framework of an inter-laboratory collaboration (ANL, LANL, JAERI/FNS). Some topics related to dosimetry standard cross sections are highlighted. In addition, recent results of several activation cross sections at a energy range from 2.0 to 3.1 MeV are given.

54365 (NEANDC–259-U, pp. 85-94) **The production of ^{49}V, ^{93}Mo, ^{93m}Nb and other long-lived isotopes in fusion materials with 14 MeV neutrons.** Greenwood, L.R. (Argonne National Lab. (US). Analytical Chemistry Lab.); Bowers, D.L. Nuclear Energy Agency, 75 - Paris (France). 1990. Contract W-31-109-Eng-38. (CONF-890982–: Specialists' meeting on neutron activation cross sections for fission and fusion energy applications, Argonne, IL (USA), 13-15 Sep 1989). In *Proceedings of a specialists' meeting on neutron activation cross sections for fission and fusion energy applications.* 351p. Order Number DE91716261. Source: NTIS (US Sales Only), PC A16/MF A01.

Results are presented for measurements of neutron cross sections for the production of ^{49}V (331 d) from vanadium and for ^{93}Mo (3500 a) and ^{93m}Nb (16 a) from natural and ^{94}Mo-enriched molybdenum targets near 14 MeV. The targets were irradiated at the Rotating Target Neutron Source II to fluences up to 10^{18} n/cm^2. Radiochemical separations were performed to separate the desired nuclides from interfering activities. Activity measurements were then performed using x-ray counting techniques. Results are compared with calculations and the measured cross sections are used to predict the level of these activities in a first-wall fusion reactor material. Previous results are also reviewed for similar measurements of the production of ^{55}Fe, ^{63}Ni, ^{59}Ni, ^{94}Nb, and ^{91}Nb. Comparisons with theoretical calculations suggest possible revisions of the halflives of ^{59}Ni and ^{91}Nb.

54366 (NEANDC–259-U, pp. 95-98) **Activation with an intense source of monoenergetic neutrons in the range 8-14 MeV.** Haight, R.C. (Los Alamos National Lab. (US)). Nuclear Energy Agency, 75 - Paris (France). 1990. (CONF-890982–: Specialists' meeting on neutron activation cross sections for fission and fusion energy applications, Argonne, IL (USA), 13-15 Sep 1989). In *Proceedings of a specialists' meeting on neutron activation cross sections for fission and fusion energy applications.* 351p. Order Number DE91716261. Source: NTIS (US Sales Only), PC A16/MF A01.

In the difficult region of neutron activation from 8- to 14-MeV neutron energy, the ^{1}H(t,n) source reaction is combined with a rotating, high pressure, hydrogen gas cell to produce an intense quasi-monoenergetic neutron flux with intensity of typically 4 x 10^9 neutrons cm^{-2} sec^{-1}. This source is characterized by a strong peak at the desired source energy with the neutrons kinematically focused in the forward direction. The effects of breakup neutrons from triton interactions with the entrance foil and the beam stop are small for many activation experiments.

54367 (NEANDC–259-U, pp. 99-110) **Measurement of activation cross sections of short-lived nuclei by 13.4-14.9 MeV neutrons.** Kawade, K. (Nagoya Univ. (JP). Faculty of Engineering); Osa, A.; Yoshida, H.; Miyachi, M.; Shibata, M.; Gotoh, Y.; Katou, K.; Yamada, T.; Yamamoto, H.; Katoh, T.; Iida, T.; Takahashi, A. Nuclear Energy Agency, 75 - Paris (France). 1990. (CONF-890982–: Specialists' meeting on neutron activation cross sections for fission and fusion energy applications, Argonne, IL (USA), 13-15 Sep 1989). In *Proceedings of a specialists' meeting on neutron activation cross sections for fission and fusion energy applications.* 351p. Order Number DE91716261. Source: NTIS (US Sales Only), PC A16/MF A01.

Activation cross sections for the reactions leading to short-lived nuclei with half-lives between 0.5 and 20 m were measured to provide nuclear data required for fusion reactor technology. Up to now, 32 cross sections for (n,2n), (n,p), (n,n'p) and (n,α) reactions have been obtained at neutron energies of 13.4 to 14.9 MeV by the activation method using the intense 14 MeV neutron source facility of Osaka University (OKTAVIAN). Some attention was paid to measure β^+ emitters and γ-rays efficiently in a short time. The total errors were within 3.6% when good counting statistics were achieved.

54368 (ORNL–6086/V1) **Atomic data for fusion: Volume 1, Collisions of H, Hsub 2, He and LI atoms and ions with atoms and molecules.** Hunter, H.T.; Kirkpatrick, M.I.; Alvarez, I.; Cisneros, C.; Phaneuf, R.A. (eds.); Barnett, C.F. Oak Ridge National Lab., TN (USA). Jul 1990. 706p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE91000527. Source: NTIS, PC A99/MF A01; OSTI; INIS; GPO Dep.

This report provides a handbook of recommended cross-section and rate-coefficient data for inelastic collisions between hydrogen, helium and lithium atoms, molecules and ions, and encompasses more than 400 different reactions of primary interest in fusion research. Published experimental and theoretical data have been collected and evaluated, and the recommended data are presented in tabular, graphical and parametrized form. Processes include excitation and spectral line emission, charge exchange, ionization, stripping, dissociation and particle interchange reactions. The range of collision energies is appropriate to applications in fusion-energy research.

54369 (ORNL/FTR–3788) **[Fusion materials R&D programs of the International Thermonuclear Experimental Reactor]: Foreign trip report, September 6, 1990–September 20, 1990.** Reuther, T.C. Oak Ridge National Lab., TN (USA). 12 Oct 1990.

11p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE91001528. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The objective of this travel was to advance provisional planning of an activity to coordinate research and development (R&D) activities on fusion materials among the existing fusion materials R&D programs of the ITER parties. This objective was accomplished in discussions with the Executive Committee for the IEA Implementing Agreement on Fusion Materials in Karlsruhe, Germany, and with the ITER management and staff of Garching, Germany. The IEA Executive Committee deferred substantive consideration of the topic at the insistence of the Ex-Officio member from European Community (EC), Brussels. Discussions with ITER management and staff were positive. It was noted the the draft ITER Long-Term Technology Research and Development Plan contains recommendations for major program effort in materials R&D and includes recommendations for coordination among the existing programs of the parties to meet those materials R&D needs. ITER management discussions were in the context that decisions on specific activities for the ITER engineering design activity (EDA) must await formal action by the parties on the ITER EDA.

54370 (ORNL/TM–11562) **Model for particle balance in pumped divertors (pre-VORTEX).** Hogan, J.T. Oak Ridge National Lab., TN (USA). Aug 1990. 20p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE91000517. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

An internally consistent model for particle transport in an open divertor geometry has been developed. Embodied in a new code, pre-VORTEX, the model couples the particle balance in the plasma core, the scrape-off layer, the open divertor channels, and the "vacuum" regions. This mutual coupling is particularly important in determining the conditions required for high recycling in the divertor. The plasma core is considered to have a relatively quiescent core region and a less well confined "edge-localized mode"(ELM) region. The scrape-off layer is modeled with one-dimensional parallel and perpendicular transport. A two-point divertor channel model is used; it is similar to previous models, but with the addition of new physical processes: hydrogen charge exchange, impurity thermal charge exchange, and flux-limited parallel transport. Wall recycling data are required to describe the differing recycling properties of the wall regions and the divertor plates. Given local plasma diffusivities and wall recycling properties, the model predicts the volume-averaged density and global particle confinement time. The input data are uncertain, and a major use for the model is to permit comparison with data. The final model, VORTEX, is intended for application to the analysis of divertor confinement experiments; it is coupled to a one-and-one-half–dimensional transport code and uses detailed geometric input from equilibrium fitting codes, experimentally measured core profiles, and such parameters as can be measured in the scrape-off layer. The pre-VORTEX model is compared as a stand-alone code with typical data from the DIII-D experiment and applied to the proposed DIII-D Advanced Divertor Project.

54371 (PNL-SA–18576) **Radiation resistance of copper alloys at high exposure levels.** Garner, F.A. (Pacific Northwest Lab., Richland, WA (USA)); Zinkle, S.J. Pacific Northwest Lab., Richland, WA (USA). Aug 1990. 17p. Sponsored by U.S. DOE Energy Research. DOE Contract AC06-76RL01830 ;AC05-84OR21400. (CONF-9009264–2: Conference on the effect of irradiation on materials of fusion reactors, Leningrad (USSR), 18-20 Sep 1990). Order Number DE91001563. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Copper alloys are currently being considered for high heat flux applications in fusion power devices. A review is presented of the results of two separate series of experiments on the radiation response of copper and copper alloys. One of these involved pure copper and boron-doped copper in the ORR mixed spectrum reactor. The other series included pure copper and a wide array of copper alloys irradiated in the FFTF fast reactor 16 refs., 13 figs.

54372 (PNL-SA–18584) **Report of the LASREF [Los Alamos Spallation Radiation Effects Facility] Evaluation Committee.** Doran, D.G. Pacific Northwest Lab., Richland, WA (USA). Jul 1990. 19p. Sponsored by U.S. DOE Energy Research. DOE Contract AC06-76RL01830. Order Number DE91001100. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The objective of this committee is to evaluate the appropriate role, both short-term and long-term, of the Los Alamos Spallation Radiation Effects Facility (LASREF) in the US Fusion Materials Program.

54373 (SAND–90-0968C) **Inertial confinement fusion with light ion beams.** Vandevender, J.P.; Adams, R.G.; Allshouse, G.O.; Bailey, J.E.; Beig, K.W.; Bloomquist, D.D.; Coats, R.S.; Cook, D.L.; Chandler, G.E.; Cuneo, M.E.; Derzon, M.S.; Desjarlais, M.P.; Dreike, P.L.; Gerber, R.A.; Hanson, D.L.; Humphreys, D.R.; Hussey, T.W.; JohnSandia National Labs., Albuquerque, NM (USA). [1990]. 10p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-901025–11: 13. international conference on plasma physics and controlled nuclear fusion research, Washington, DC (USA), 1-6 Oct 1990). Order Number DE91001224. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

Advances are reported in the theory and experiments investigating Inertial Confinement Fusion with light ion beams on the Particle Beam Fusion Accelerator II (PBFA II). Impedance of the accelerating gap, electron-ion instabilities, proton beam generation and focusing at 300 kJ, proton driven target experiments to measure beam non-uniformity, lithium beam generation and focusing at 185 kJ, and plasma opening switch improvements for voltage and power gain are reported.

54374 (SAND–90-2503C) **Thermal-hydraulic design issues and analysis for the ITER [International Thermonuclear Experimental Reactor] divertor.** Koski, J.A. (Sandia National Labs., Albuquerque, NM (USA)); Watson, R.D.; Hassanien, A.M.; Goranson, P.L.; Salmonson, J.C. Sandia National Labs., Albuquerque, NM (USA). [1990]. 22p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-901007–16: 9. topical meeting on technology of fusion energy, Oak Brook, IL (USA), 7-11 Oct 1990). Order Number DE91001264. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Critical Heat Flux (CHF), also called burnout, is one of the major design limits for water-cooled divertors in tokamaks. Another important design issue is the correct thermal modeling of the divertor plate geometry where heat is applied to only one side of the plate and highly subcooled flow boiling in internal passages is used for heat removal. This paper discusses analytical techniques developed to address these design issues, and the experimental evidence gathered in support of the approach. Typical water-cooled divertor designs for the International Thermonuclear Experimental Reactor (ITER) are analyzed, and design margins estimated. Peaking of the heat flux at the tube-water boundary is shown to be an important issue, and design concerns which could lead to imposing large design safety margins are identified. The use of flow enhancement techniques such as internal twisted tapes and fins are discussed, and some estimates of the gains in the design margin are presented. Finally, unresolved issues and concerns regarding hydraulic design of divertors are summarized, and some experiments which could help the ITER final design process identified. 23 refs., 10 figs.

54375 (SAND–90-2579C-Draft) **A benchmark comparison of predicted x-ray and neutron doses for a nuclear effects test in the Laboratory Microfusion Facility.** Beller, D.E. (Air Force Inst. of Tech., Wright-Patterson AFB, OH (USA)); Tobin, M.T.; Lorence, L.J. Sandia National Labs., Albuquerque, NM (USA). 18 Sep 1990. 8p. Sponsored by U.S. Department of Defense. DOE Contract AC04-76DP00789. (CONF-901007–17-Draft: 9. topical meeting on technology of fusion energy, Oak Brook, IL (USA), 7-11 Oct 1990). Order Number DE91001340. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

An intermediate step in the development of inertial confinement fusion (ICF) for power production will be the development and testing of a high-gain facility. One concept being considered for this facility is the Laboratory Microfusion Facility (LMF). Other projected applications of the LMF include high-energy-density physics experiments and nuclear effects testing. At the Air Force Institute of Technology (AFIT), Lawrence Livermore National Laboratory

(LLNL), and Sandia National Laboratories Albuquerque (SNLA), we have been studying the use of the LMF for nuclear effects experiments. Because of the amount of energy that will be released in a high-gain ICF test and the size of the LMF, test objects could be any size from very small electronic components to large systems; and nuclear effects in the LMF may include thermal radiation, x-rays, electromagnetic pulse, gamma rays, neutrons, or others. At AFIT, LLNL, and SNLA we have been investigating a test to expose systems to high-energy x-ray pulses, and have completed predictions of x-ray fluence, dose, etc. in various conceptual LMF reactors. However, comparison of our results is more meaningful if our prediction methods produce the same results for the same design. To establish a basis for comparison, we set up a simple benchmark problem and we each computed x-ray and neutron transport. The model and codes are described and the results are compared and discussed.

54376 (UCRL-CR–103819) **A note on the pressure field within an outward moving free annulus.** Chen, X.M. (California Univ., Berkeley, CA (USA). Dept. of Nuclear Engineering); Schrock, V.E. Lawrence Livermore National Lab., CA (USA); California Univ., Berkeley, CA (USA). Dept. of Nuclear Engineering. [1990]. 8p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-901007–13: 9. topical meeting on technology of fusion energy, Oak Brook, IL (USA), 7-11 Oct 1990). Order Number DE91000948. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The outward radial expansion of a free liquid annulus is a common problem of both earlier and current ICF blanket design. Whether the annulus fractures or not depends on the internal pressure and surface stability. In this paper a model based on incompressible cylindrically symmetric flow is used to get a theoretical solution similar to that of the Rayleigh's solution for bubble dynamics. The pressure inside the annulus is found positive all time but the peak is lowering during the expansion. Besides, both surfaces are Taylor stable during such motion. Thus, it is concluded that an annulus in outward radial motion will not cavitate or breakup.

54377 (UCRL-CR–104813) **Recent long-pulse and high-average-power tests on a 140 GHz gyrotron.** Felch, K. (Varian Associates, Inc., Palo Alto, CA (USA)); Hess, C.; Huey, H.; Jongewaard, E.; Jory, H.; Neilson, J.; Pendleton, R.; Tsirulnikov, M. Lawrence Livermore National Lab., CA (USA); Varian Associates, Inc., Palo Alto, CA (USA). Oct 1990. 5p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-48. Order Number DE91001680. Source: NTIS, PC A01/MF A01; OSTI; INIS; GPO Dep.

Varian is carrying out the development of high-power, CW gyrotrons at frequencies ranging from 100–140 GHz. Initial test vehicles at 140 GHz have been designed to generate short-pulse power levels of 1 MW and up to 400 kW CW. Thus far, short-pulse power levels of 1040 kW have been measured at 38% efficiency and average powers of 200 kW have been achieved. Output power levels of 400 kW have been obtained for pulse durations of 0.5 sec. 2 refs., 3 figs., 1 tab.

54378 (UCRL-CR–106119) **Progress in producing megawatt gyrotrons for ECR [electron cyclotron resonance] heating.** Felch, K. (Varian Associates, Inc., Palo Alto, CA (USA)); Hess, C.; Huey, H.; Jongewaard, E.; Jory, H.; Neilson, J.; Pendleton, R.; Tsirulnikov, M. Lawrence Livermore National Lab., CA (USA). Oct 1990. 7p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-48. Order Number DE91001681. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

Varian is carrying out the development of high-power, CW gyrotrons at frequencies ranging from 100–500 GHz for use in electron cyclotron resonance (ECR) heating of magnetically-confined plasma. Initial test vehicles at 140 GHz have utilized $TE_{15,2,1}$ interaction cavities, and have been designed to generate short-pulse (up to 20 ms) power levels of 1 MW and up to 400 kW CW. Recently, short-pulse power levels of 940 kW at 35% efficiency have been obtained and average powers of 200 kW have been achieved at peak powers of 400 kW. Long-pulse testing is currently underway. Initial test have resulted in output levels of 400 kW for pulse durations of 380 ms. Design work on 110 GHz, 500 kW CW gyrotron oscillators has recently been completed and a prototype tube has been assembled and is currently being tested. The design of a 110 GHz, 1 MW CW gyrotron, using a novel output coupling approach, is nearly complete. Fabrication of the first 1 MW CW experimental tube is in progress.

54379 (UCRL-JC–103491) **A characterization of internal-Sn Nb_3Sn superconductors for use in the Proof of Principles (PoP) coil.** Summers, L.T. (Lawrence Livermore National Lab., CA (USA)); Duenas, A.R.; Karlsen, C.E.; Ozeryansky, G.M.; Gregory, E. Lawrence Livermore National Lab., CA (USA). 21 Sep 1990. 6p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-48. (CONF-900944–13: Applied superconductivity conference, Aspen, CO (USA), 24-28 Sep 1990). Order Number DE91001743. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

High performance Ti-alloyed internal-Sn superconductors have been selected for use in the Proof of Principles (PoP) coil, and a 1.0 m o.d., 0.4 m i.d., solenoid designed to produce fields up to 15 T. The PoP coil, which will use forced-flow Cable-In-Conduit Conductors (CICC), will operate at 4.2 K and moderate levels of conductor strain. Here we report the results of detailed characterizations of two proposed PoP coil Nb_3Sn 19 subelement superconductor wires of different topology. We have investigated the critical current as a function of applied field, and applied strain. The wires were found to have excellent high field properties, providing a high performance margin for the proposed PoP coil. The field and strain dependence of J_c have been found to compare favorably with predictions from a wire performance model recently developed for Nb_3Sn superconductors. 5 refs., 6 figs., 2 tabs.

54380 (UCRL-JC–104815) **A MAGICTRAC [Microwave Antenna for Whispering-Gallery-Mode Conversion using a Twist Reflector Antenna Converter] design for the MTX [Microwave Tokamak Experiment] transport system.** Makowski, M.A. (TRW, Inc., Redondo Beach, CA (USA)); Stallard, B.W.; Byers, J.A. Lawrence Livermore National Lab., CA (USA). Sep 1990. 9p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-48. (CONF-901245–1: . 15. international conference on infrared and millimeter waves, Orlando, FL (USA), 10-14 Dec 1990). Order Number DE91000807. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

A design of a MAGICTRAC (Microwave Antenna for Whispering-Gallery-Mode Conversion using a Twist Reflector Antenna Converter) device is presented for use on the MTX (Microwave Tokamak Experiment) transport system. The MAGICTRAC device, consisting of a mode converting waveguide taper and three metal reflectors, transforms the $TE_{15,2}$ circular waveguide mode output of a VARIAN Associates 140 GHz gyrotron into a free-space Gaussian-like beam with >95% efficiency. Dimensions of the MAGICTRAC are chosen to produce a beam matched to the MTX quasi-optical transport system.

54381 (UCRL-JC–105000) **Strategy and tactics in the search for new harmonic generating crystals.** Velsko, S.P. Lawrence Livermore National Lab., CA (USA). Sep 1990. 24p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-9004244–1: American Chemical Society (ACS) symposium on non-linear materials (NLO) conference, Boston, MA (USA), 23 Apr 1990). Order Number DE91000281. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Three basic questions must be answered to ensure success in the search for an optimized nonlinear crystal for a particular application: What are the most important optical properties which determine the crystal's figure of merit for the intended application? What is the best methodology for characterizing those optical properties so that materials of interest can be identified efficiently? Where in "materials space" can crystals with such properties be found with the highest probability? Answers to these questions will be discussed in the context of a program to find improved frequency conversion crystals for high power lasers. 27 refs., 9 figs.

54382 (UCRL-JC–105056) **Comments on open-ended magnetic systems for fusion.** Post, R.F. Lawrence Livermore National Lab., CA (USA). 24 Sep 1990. 25p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-48. (CONF-9010209–2: Workshop on physics of alternative magnetic

confinement schemes, Varenna (Italy), 14-15 Oct 1990). Order Number DE91000972. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Differentiating characteristics of magnetic confinement systems having externally generated magnetic fields that are "open" are listed and discussed in the light of their several potential advantages for fusion power systems. It is pointed out that at this stage of fusion research "high-Q" (as deduced from long energy confinement times) is not necessarily the most relevant criterion by which to judge the potential of alternate fusion approaches for the economic generation of fusion power. An example is given of a hypothetical open-geometry fusion power system where low-Q operation is essential to meeting one of its main objectives (low neutron power flux).

54383 (WHC-SA–0916) **Consequences of water injection into high-temperature lithium-lead alloy breeder material.** Jeppson, D.W. (Westinghouse Hanford Co., Richland, WA (USA)); Savatteri, C. Westinghouse Hanford Co., Richland, WA (USA). Oct 1990. 9p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC06-87RL10930. (CONF-901007–15: 9. topical meeting on technology of fusion energy, Oak Brook, IL (USA), 7-11 Oct 1990). Order Number DE91001189. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

A fusion safety experiment was conducted to determine the consequences of water injection into high-temperature lithium-lead alloy under postulated reactor accident conditions. The temperature and pressure response, fraction of water reacted, quantity of hydrogen produced, and behavior of radioactive species associated with the use of this alloy as a breeder material were determined. The reaction products were identified and the aerosol was characterized for particle size, chemical composition, and deposition rate. The water injection was shown to be self limiting for a blanket module designed to withstand the pressure of the water coolant. Radioactive doses associated with the aerosol release from a high-temperature alloy breeder module were determined to be several orders of magnitude below the dose limit for acute health effects. The results were compared to previous experiments and recommendations were made. 5 refs., 7 figs., 6 tabs.

54384 Multi-megagauss magnetic field generation on saturn. Spielman, R.B. (Sandia National Lab., Albuquerque, NM (US)); Hussey, T.W.; Hanson, D.L.; Lopez, S.F. pp. 43-54 of Megagauss fields and pulsed power systems. Titov, V.M.; Shvetsov, G.A. Nova Science Publishers, Inc., Commack, NY (USA) (1990). pp. 859 DOE Contract AC04-76DP00789. (CONF-890710–: 5. international conference on megagauss magnetic field generation and related topics, Novosibirsk (USSR), 3-7 Jul 1989).

Very large magnetic fields were first produced using electrical discharges through coils. More recently, many researchers have used the method of explosively-driven flux compression to generate megagauss magnetic fields. The authors reported using Proto-II, a 10 TW electrical accelerator, to directly generate fields up to 1.5 kT (15 MG) in a coaxial geometry. The development of even larger electrical accelerators has now allowed them to directly generate magnetic fields of magnitudes equivalent to the largest values attained with explosively-driven flux compression generators. In this paper they report experimental results in which the Saturn accelerator delivered a peak current of 10.5 MA to a 2-mm diameter tungsten rod, thereby generating a peak magnetic field of ~ 2.1 kT (21 MG). They also show the results of one-dimensional (1-D) calculations which show that peak fields of 2.1 kT were achieved at the surface of the tungsten rod.

54385 Evidence for population inversion and possible lasing at 150.6, 154.6 and 187.3 Å in pulsed power driven Z-pinches. Krishnan, M. (Physics International Co., San Leandro, CA (US)); Nash, T.; LePell, P.D. pp. 39-43 of Short and ultrashort wavelength lasers. Jones, C.R. Society of Photo-Optical Instrumentation Engineers, Bellingham, WA (USA) (1988). pp. 193 (CONF-8801144–: Short and ultrashort wavelength lasers meeting, Los Angeles, CA (USA), 14-15 Jan 1988).

This paper reports the DNA/PITHON pulsed power generator used to produce hot, dense, aluminum plasmas in a Z-pinch configuration. An annulus of neon gas was radially imploded on to a parylene capillary on axis, which was coated with aluminum. The pinch produced 3 cm and 5 cm long Al plasmas with densities ~ 10^{20} cm^{-3} and temperatures ~ 500 eV, with a 25 ns duration. After the implosion, the Al plasma expanded and cooled for the next 50 ns, producing Li-like Al XI ions by recombination from He-like Al XII ions. A time- gated, grazing incidence spectrograph (MCPIGS) was used to image the expanding plasma and to capture three consecutive 25 ns duration spectra. The Al XI, 4f-3d and 4d-3p lines at 154.6 and 150.6 Å were observed to be anomalously bright compared to the Al XI, 4d-2p line. Also, the Ne X, 4- 3 line at 187.3 Å was brighter than the Ne X, 4-2 Balmer-β line. Spatial and temporal variations of these lines suggest an inversion of the 4d and 4f levels in Al XI and of the n = 4 level in Ne X, driven by three-body recombination.

54386 Modeling flux compression generators with a 2D ALE code. Tipton, R. (Lawrence Livermore National Lab., Livermore, CA (US)). pp. 217-232 of Megagauss fields and pulsed power systems. Titov, V.M.; Shvetsov, G.A. Nova Science Publishers, Inc., Commack, NY (USA) (1990). pp. 859 DOE Contract W-7405-ENG-48. (CONF-890710–: 5. international conference on megagauss magnetic field generation and related topics, Novosibirsk (USSR), 3-7 Jul 1989).

A 2D MHD ALE (Arbitrary Lagrangian Eulerian) code has been developed to aid in the design and understanding of magnetic flux compression generators. The hydro treatment is Lagrangian ahead of the armature-stator contact point and Eulerian behind. The code tracks the location of the high explosive detonation front and deposits the chemical energy behind it. Realistic equations of state are used for the detonation products, armature and stator. Strength of material effects for the armature and stator are included. The magnetic diffusion equations are solved implicitly and the magnetic forces are included in the hydrodynamic equations. The code has been used to model the performance of a coaxial flux compression generator as well as a continuously variable pitch, continuously variable conductor diameter helical generator. Calculated results for each generator are presented and in the case of the coaxial generator, compared with data. The limitations of the code are discussed.

54387 Plasma flow switch driven implosions. Baker, W.L. (Weapons Lab., Kirtland AFB, NM (US)); Beason, J.D.; Degnan, J.H.; Hackett, K.E.; Hall, D.J.; Holmes, J.L.; Price, D.W.; Grahan, J.D.; Lopez, E.A.; Bird, G.; Boyer, C.B.; Coffey, S.K.; Davis, J.F. III; Seiler, S.W.; Turchi, P.J.; Buff, J.S.; Fr pp. 615-622 of Megagauss fields and pulsed power systems. Titov, V.M.; Shvetsov, G.A. Nova Science Publishers, Inc., Commack, NY (USA) (1990). pp. 859 (CONF-890710–: 5. international conference on megagauss magnetic field generation and related topics, Novosibirsk (USSR), 3-7 Jul 1989).

Using a 1300 microfarad, 3 nanohenry, 120 kV, 9.4 MJ Shiva Star capacitor bank, the authors have done vacuum inductive store plasma flow switch driven implosion experiments. This technique employs a co-axial discharge through a plasma armature, which stores magnetic energy over 3 to 4 microseconds and rapidly transfers it to an implosion load. The implosion load is a 5 cm radius, 2 cm tall, 200 to 400 microgram/cm^2 cylindrical foil. With 5 megajoules of capacitively store energy, over 9 megamperes is delivered to the implosion load with a rise time ~ 200 nanoseconds, resulting in a radiation pulse exceeding 5 terawatts, assuming isotropic emission. Experimental results and 2D-MHD simulations are discussed.

54388 Bibliography of fusion product physics in tokamaks. Hively, L.M. (Oak Ridge National Lab., Oak Ridge, TN (US)); Signmar, D.J. *Fusion Technology (USA)*, 17(2): 316-342 (Mar 1990).

This paper presents almost 700 citations compiled on recent research on fusion product effects in tokamaks.

54389 An analysis of cold and lukewarm fusion. Rabinowitz, M. (Electric Power Research Institute, Palo Alto, CA (US)); Worledge, D.H. *Fusion Technology (USA)*, 17(2): 344-349 (Mar 1990).

Experimental reports continue to suggest that the crystal-line solid state may present a unique environment for deuteron-deuteron (d-d) fusion at ambient temperature (cold fusion). The analysis presented shows that newly reported cluster-impact d-d

fusion at energies ~ 100 eV hs much in common with cold fusion and might appropriately be called lukewarm fusion. Both phenomena evidently need a novel theoretical approach for their understanding. A deuteron effective mass approach is proposed as a possible explanation of the reported experimental results.

54390 Pulse length assessment of compact ignition tokamak designs. Stotler, D.P. (Princeton Univ., NJ (USA). Plasma Physics Lab.); Pomphrey, N. *Fusion Technology (USA),* 17(4): 577-587 (Jul 1990).

A time-dependent zero-dimensional code has been developed to assess the pulse length and auxiliary heating requirements of compact ignition tokamak (CIT) designs. By taking a global approach to the calculation, parametric studies can be easily performed. The accuracy of the procedure is tested by comparison with the tokamak simulation code, which uses theory-based thermal diffusivities. A series of runs is carried out at various levels of energy confinement for each of three possible CIT configurations. It is found that for cases of interest ignition or an energy multiplication factor $Q \geq 7$ can be attained within the first half of the planned 5-s flattop with 10 to 40 MW of auxiliary heating. These results are supported by analytic calculations.

54391 Accident safety comparison of elements to define low-activation materials. Piet, S.J. (Idaho National Engineering Lab., Idaho Falls, ID (USA)); Cheng, E.T.; Porter, L.J. *Fusion Technology (USA),* 17(4): 636-657 (Jul 1990). DOE Contract AC07-76ID01570.

The meaning of low activation is quantified with regard to accident safety for naturally occurring elements from hydrogen through bismuth. The activation inventory from a 5 MW/m^2 neutron flux for a 4-yr exposure at the first wall to a deuterium-tritium plasma was used for four figures of merit (FOM): prompt dose rating, based on the release fraction required to avoid any off-site acute radiation fatalities, relevant to inherent safety; latent dose rating, based on the allowable release fraction to minimize off-site latent statistical cancers, relevant to risk-based goals; time before damage, based on the initial temperature rise rate from decay heat and the time available before damage (a 300°C temperature rise); and maximum temperature rise, based on the maximum temperature rise. The first two FOM use the radioactive inventory and off-site dose calculations using the FUSCRAC3 computer code. The second two FOM are based on decay heat and simple generic blanket thermal models. The comparisons provide quantitative guidance for desired material compositions for those materials receiving high neutron fluence.

54392 A combined microwave cavity and photographic diagnostic for high-speed projectiles. Gouge, M.J. (Oak Ridge National Laboratory, Oak Ridge, TN (USA)); Combs, S.K.; Milora, S.L. *Review of Scientific Instruments (USA),* 61(8): 2102-2105 (Aug 1990). DOE Contract AC05-84OR21400.

A combined microwave cavity and photographic diagnostic for high-speed projectiles has been developed. The diagnostic allows consistent determination of projectile mass and shape and serves as one fiducial mark for a speed measurement. The 3.219-GHz cavity has been used for experiments with both frozen deuterium and plastic pellets traveling at speeds from 1500–4500 m/s.

54393 Railgun restrike control. Parker, J.V. To Dept. of Energy, Washington, DC (USA). USA Patent 4,945,810/A/. 7 Aug 1990. Filed date 11 Apr 1989. USA Patent patents application 7-336,377. Int. Cl. F41B 6/00. 4p. Source: Patent and Trademark Office, Box 9, Washington, DC 20232 (USA).

This patent describes an electromagnetic railgun having electrically conductive segments overlying but insulated from the rails. Switches are connected between each segment and its underlying rail. As a projectile and its plasma armature pass each segment, the switch associated with that segment opens, disconnecting the flow of current into the area behind the plasma armature. Without a source of current, parasitic current flow is prevented.

99 GENERAL AND MISCELLANEOUS

54394 (CDTN–ASPC.CN-001/89) **Semi-annual report of Nuclear Technology and Development Center (CDTN) - July to December 1988.** Centro de Desenvolvimento da Tecnologia Nuclear (CDTN), Belo Horizonte, MG (Brazil). 1989. 353p. (In Portuguese). Order Number DE91606188. Source: NTIS (US Sales Only), PC A16/MF A01; OSTI; INIS.

The main activities developed by the several divisions of Nuclear Technology Development Center (CDTN) are described, including areas of reactor tecnologies, fuel cycle, materials and component, nuclear safety and tecnical substructure. (C.G.C.).

54395 (HMI-B–468) **HMI scientific publications 1988.** Hahn-Meitner-Institut Berlin GmbH (Germany, F.R.). Jul 1989. 106p. (In German). Source: Available from Hahn-Meitner-Institut Berlin GmbH (Germany, F.R.).

The publications of the staff of the Hahn-Meitner-Institute (HMI) are listed in this catalogue. It contains articles which have been published in journals, books or book chapters, theses or HMI-reports in 1988. Only those publications are included of which a copy was provided to the library. Each title is indexed by a publication number, composed of a code indicating the field of research, the year of publication, and a running number. The fields of research are physics, chemistry, solid state and materials research, and information techniques. The research reactor BER II, the heavy ion accelerator VICKSI, the central information and computer operation, the electronics, and the central library belong to the infrastructure of the HMI. (HK).

54396 (NUREG/CP–0107) **Security training symposium: Meeting the challenge: Firearms and explosives recognition and detection: Proceedings.** Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Material Safety and Safeguards. Sep 1990. 298p. Sponsored by Nuclear Regulatory Commission. (CONF-8911243–: Security training symposium: meeting the challenge – firearms and explosives recognition and detection, Bethesda, MD (USA), 28-30 Nov 1989). Source: NTIS, PC A13/MF A01 - GPO - OSTI.

These conference proceedings have been prepared in support of the US Nuclear Regulatory Commission's Security Training Symposium on "Meeting the Challenge – Firearms and Explosives Recognition and Detection," November 28 through 30, 1989, in Bethesda, Maryland. This document contains the edited transcripts of the guest speakers. It also contains some of the speakers' formal papers that were distributed and some of the slides that were shown at the symposium (Appendix A).

54397 (RFP–4439) **Synergetic conferencing: A process for formative evaluation.** Zounar, E.D. EG and G Rocky Flats, Inc., Golden, CO (USA). [1990]. 9p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC34-90DP62349. (CONF-9010208–1: 14. annual TRADE conference, Denver, CO (USA), 22-24 Oct 1990). Order Number DE91001000. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Improved instruction is a purpose of instructor evaluations. Continuous cycles of conferences encourage synergism or teamwork between an instructor and evaluator. Pre-observation conference, focused observation, and post-observation conference are the three components of the evaluation cycle. Data recorded during the observation are analyzed for pervasive patterns of instructional behaviors. A follow-up report describes the outcomes of the evaluation and lays out a professional growth plan for the instructor. The reported information can be fed back into a system of instructor evaluation for staff development purposes. 3 refs., 1 fig.

9901 Management

Refer also to citation(s) 52898, 53022, 53059, 53070, 53124, 54444, 54448, 54449

54398 (CDTN–ASPC.CN-001/89, pp. 22-38) **Semi-annual report of the Mineral Technology Department from CDTN - July to December 1988.** Coelho, S.V.; Fernandes, M.D.; Goicalves, J.R.; Murta, R.L.L. Centro de Desenvolvimento da Tecnologia Nuclear (CDTN), Belo Horizonte, MG (Brazil). 1989. (In Portuguese).

In *Semi-annual report of Nuclear Technology and Development Center (CDTN) - July to December 1988.* 353p. Order Number DE91606188. Source: NTIS (US Sales Only), PC A16/MF A01; OSTI; INIS.

The activities developed by the Mineral Technology Department of CDTN during 1988, in the area of chemical analysis, mineralogy, petrography and studies about mineral characterization are described. (E.G.).

54399 (CNIC-I-004) **IMP annual report, 1988 (January-December).** China Nuclear Information Centre, Beijing, BJ (China); Academia Sinica, Lanzhou, GS (China). Inst. of Modern Physics. Jun 1990. 138p. Order Number DE91606195. Source: NTIS (US Sales Only), PC A07/MF A01; OSTI; INIS.

The research activities of Institute of Modern Physics, Academia Sinica of China, during the year of 1988, was summarized in this annual report. A highlight of these activities during the year was the progress of HIRFL project. HIRFL was delivered successfully 50 MeV/A ^{12}C beam on december 12, 1988. The scientific paper contained in this annual report are concerning to the fundamental scientific research, mainly nuclear physics. The development on experimental technique and the research on application of nuclear techniques have been reported also. It divided into ten parts, more than ninety pieces of short notes were presented.

54400 (DOE/IG-0289) **Departmentwide audit of architect and engineering design costs.** USDOE Office of Inspector General, Washington, DC (USA). Capital Regional Audit Office. 18 Sep 1990. 32p. Sponsored by U.S. DOE Office of Inspector General. Source: OSTI (Free of Charge).

Report to The Secretary.

Since Fiscal Year 1984, the costs of the Department of Energy's (DOE) construction projects have averaged $1.7 billion a year. This amount is expected to grow substantially as DOE modernizes and upgrades its facilities. New projects, such as the superconducting super collider, will add several billions to those costs. Architect and engineering (AE) support to construction projects, which begins with the initial concept design, becomes intensive after the Congress authorizes funds for construction. AE support continues to the end of construction with responsibility for final inspection and drawings of the completed project. This process can take several years. The Department spends an estimated $160 million a year for AE design services. Since the procurement of AE services is not subject to the same competitive process as procurement of other goods and services in the Government, there is a special need to ensure that AE costs are adequately controlled. A DOE report issued in 1984 included a finding on the need for more stringent cost controls over procurement of AE design services. This Department wide review was made to determine the reasonableness of current AE design costs and examine existing controls over those costs.

54401 (DOE/IG-0290) **Report on the general management inspection of the San Francisco Operations Office.** USDOE Office of Inspector General, Washington, DC (USA). Office of Assistant Inspector General for Inspections. 20 Sep 1990. 173p. Sponsored by U.S. DOE Office of Inspector General. Source: OSTI (Free of Charge).

DOE officials have been criticized regarding their management of management and operating contractors – especially in areas such as: compliance with environmental, safety, and health laws and regulations; maintenance of facilities; and management of major projects. The inspection of the San Francisco Operations Office is the first in a series of operations office inspections. As we conduct these inspections, we expect to: (1) make recommendations to improve the Department's management economy, efficiency and effectiveness (2) report on the responsibilities and roles of operations offices in managing DOE facilities and (3) report on the differences between the various operations offices in terms of what is expected of them, and the manner in which they perform their respective missions. This report contains information of the San Francisco Operations office and is not intended to represent all operations offices.

9902 Mathematics and Computers

Refer also to citation(s) 52686, 52689, 52751, 52780, 52781, 52795, 52806, 52812, 52948, 52962, 52972, 53017, 53040, 53074, 53075, 53076, 53132, 53146, 53183, 53229, 53385, 53405, 53412, 53414, 53415, 53416, 53444, 53449, 53457, 53473, 53527, 53532, 53542, 53603, 53772, 53789, 53804, 53834, 53975, 54067, 54210, 54222, 54224, 54257, 54445, 54447, 54450, 54451

54402 (AD-A-223897/0/XAB) **Concepts of concurrent programming. Final report.** Bustard, D.W. Carnegie-Mellon Univ., Pittsburgh, PA (USA). Software Engineering Center. Apr 1990. 55p. Contract F19628-90-C-0003. (SEI/CM-24). Source: NTIS, PC A04/MF A01.

A concurrent program is one defining actions that may be performed simultaneously. This module discusses the nature of such programs and provides an overview of the means by which they may be constructed and executed. Emphasis is given to the terminology used in this field and the underlying concepts involved. This module is largely concerned with explicit concurrency, where concurrent behavior is specified by the program designer. Particular attention is paid to programs that can be considered inherently concurrent, that is, programs that are constructed to control or model physical systems that involve parallel activity. The module also includes a brief introduction to performance-oriented concurrency, where concurrency is used to improve program performance by taking advantage of hardware support for parallel processing. The module is divided into three sections. The first deals with basic concepts in concurrent programming, covering characteristic attributes, formal properties, standard design problems, and execution details. The second section discusses the steps in constructing concurrent programs for specification to coding. The final section briefly examines concurrency from the point of view of some common application areas. The module gives a foundation for a deeper study of specific topics in concurrent programming. It also provides the preparatory material for a study of the concurrent aspects of application areas such as real-time (embedded) systems, database systems, operating systems, and many simulation systems.

54403 (AD-A-224153/7/XAB) **Superconcurrent processing - a dynamic approach to heterogeneous parallelism.** Freund, R.F. Naval Ocean Systems Center, San Diego, CA (USA). Feb 1990. 15p. Source: NTIS, PC A03/MF A01.

Pub. in IEEE Processings, Feb 90.

This reprint describes an approach to finding and using an optimal, heterogenous suite of processors to solve supercomputing problems. This technique, called superconcurrency, currently works best when the computational requirements are diverse and significant portions of the code are not tightly-coupled. It is also dependent on new methods of benchmarking and code profiling, as well as eventual use of artificial intelligence techniques for intelligent management of the selected superconcurrent suite. This latter technique, combined with anticipated bandwidth increases, will permit much more closely coupled code portions to be distributed on the heterogeneous suite. This paper also presents theoretical and empirical results to show SIMD architectures are faster than vector architectures for processing long vectors. Implications for future architectures and distributed heterogeneous processing in general are also discussed.

54404 (AD-A-224182/6/XAB) **Parallel smoothing.** Tewfik, A.H.; Willsky, A.S.; Levy, B.C. Massachusetts Inst. of Tech., Cambridge, MA (USA). 1990. 8p. Contract DAAL03-86-K-0171. Source: NTIS, PC A02/MF A01.

Pub. in Systems and Control Letters, Vol. 14, 253-259(1990).

This paper describes a smoothing algorithm that involves the parallel processing of the data in the subintervals with little communication among the processors. Data in the subintervals are first processed in parallel starting from subinterval centers and processing outward to the subinterval boundaries. After an exchange of information among processors, a final set of parallel recursions, proceeding inward in each subinterval, yields the desired estimates. The proposed procedure is found in general to have a total on-line computational complexity slightly higher than that of the non-parallel implementations. However, since several processors are used in parallel, the running time of this algorithm is much

smaller than that of a single smoother solution. Furthermore when the process to be estimated is reversible, an even-odd decomposition of the process yields a block diagonalization that yields a further, considerable reduction in the required computations.

54405 (AD-A-224229/5/XAB) **Image processing and the Arithmetic Fourier Transform.** Tufts, D.W.; Fan, Z.; Cao, Z. Rhode Island Univ., Kingston, RI (USA). 1989. 9p. Contract DAAL03-86-K-0108. Source: NTIS, PC A02/MF A01.

Pub. in SPIE v1058 High Speed Computing II, 46-53(1989).

A new Fourier technique, the Arithmetic Fourier Transform (AFT) was recently developed for signal processing. This approach is based on the number-theoretic method of Mobius inversion. The AFT needs only additions except for a small amount of multiplications by prescribed scale factors. This new algorithm is also well suited to parallel processing. And there is no accumulation of rounding errors in the AFT algorithm. In this reprint, the AFT is used to compute the discrete cosine transform and is also extended to 2-D cases for image processing. A 2-D Mobius inversion formula is proved. It is then applied to the computation of Fourier coefficients of a periodic 2-D function. It is shown that the output of an array of delay-line (or transversal) filters is the Mobius transform of the input harmonic terms. The 2-D Fourier coefficients can therefore be obtained through Mobius inversion of the output of the filter array.

54406 (AD-A-224267/5/XAB) **Fault-tolerant design for multistage routing networks. Memorandum report.** DeHon, A.; Knight, T.; Minsky, H. Massachusetts Inst. of Tech., Cambridge, MA (USA). Artificial Intelligence Lab. Apr 1990. 21p. Contracts N00014-88-K-0825, N00014-85-K-0124. (AI-M-1225). Source: NTIS, PC A03/MF A01.

As the size of digital systems increases, the average length of time between single component failures diminishes. To avoid component related failures, large computers must be fault-tolerant; that is, the computer must perform correctly even when some components fail. This paper concentrates on providing fault-tolerance in the interconnection network for massively parallel MIMD computers. Particularly, the focus is on methods for achieving a high degree of fault-tolerance in multistage routing networks. A multipath scheme is described for providing end-to-end fault-tolerance on large networks. The scheme improves routing performance while keeping network latency low. The novel routing component RN1 is described which implements this scheme, showing how it can be the basic building block for fault-tolerant multistage routing networks.

54407 (AD-A-224407/7/XAB) **Execution time support for adaptive scientific algorithms on distributed memory machines. Final contractor report.** Berryman, H.; Saltz, J.; Scroggs, J. National Aeronautics and Space Administration, Hampton, VA (USA). Inst. for Computer Applications in Science and Engineering. May 1990. 21p. Contracts N00014-86-K-0310, NAS1-18605. (ICASE-90-41). Source: NTIS, PC A03/MF A01.

We consider optimizations that are required for efficient execution of code segments that cónsists of loops over distributed data structures. The PARTI (Parallel Automated Runtime Toolkit at ICASE) execution time primitives are designed to carry out these optimizations and can be used to implement a wide range of scientific algorithms on distributed memory machines. These primitives allow the user to control array mappings in a way that gives an appearance of shared memory. Computations can be based on a global index set. Primitives are used to carry out gather and scatter operations on distributed arrays. Communications patterns are derived at runtime, and the appropriate send and receive messages are automatically generated.

54408 (AD-A-224431/7/XAB) **Propagation of chaos and the McKean-Vlasov equation in duals of nuclear spaces.** Chiang, T.S.; Kallianpur, G.; Sundar, P. North Carolina Univ., Chapel Hill, NC (USA). Center for Stochastic Processes. May 1990. 48p. Contract F49620-85-C-0144. (TR-298). Source: NTIS, PC A03/MF A01.

The paper is concerned with propagation of chaos problems for systems with an infinite number of degrees of freedom such as strings or spatially extended neurons. The investigation of the asymptotic behavior of the voltage (membrane) potentials of large assemblages of interacting neurons leads to precisely such problems and provided the immediate motivation for the work. Another example to which the approach of the present paper could be applied is the Ginsburg-Landau model in hydrodynamics. Basic properties of duals of nuclear spaced (denoted throughout by Psi, the strong dual of a countably Hilbertian nuclear space Psi) are briefly discussed and the results for Kallianpur et al. on the existence and uniqueness of the solution to (the martingale problem posed by) a Psi-valued stochastic differential equation (SDE) is extended to a system of such equations. The principal results in which the infinite dimensionality of our problem call for special arguments are derived.

54409 (AD-A-224556/1/XAB) **Arithmetic Fourier transform and adaptive delta modulation: A symbiosis for high speed computation.** Tufts, D.W.; Sadasiv, G. Rhode Island Univ., Kingston, RI (USA). Dept. of Electrical Engineering. 1988. 12p. Contract DAAL03-86-K-0108. Source: NTIS, PC A03/MF A01.

Pub. in SPIE, Vol. 880 High Speed Computing, 168-178(1988).

This report presents preliminary results on the VLSI design and implementation of a novel and promising algorithm for accurate high-speed Fourier analysis and synthesis. The Arithmetic Fourier Transform is based on the number -theoretic method of Mobius inversion. Its computations proceed in parallel and the individual operations are very simple. Except for a small number of scalings in one stage of the computation, only multiplications by 0, +1, and -1 are required. If the input samples were not quantized and if deal real-number operations were used internally, then the results would be exact. The accuracy of the computation is limited only by the input A/D conversion process, any constraints on the word lengths of internal accumulating registers, and the implementation of the few scaling operations. Motivated by the goal of efficient, effective, high-speed realization of the algorithm in an integrated circuit, we introduce further simplicities by the use of delta modulation to represent the input function in digital form. The result is that only binary (or preferably, ternary) sequences need to be processed in the parallel computations. And the required accumulations can be replaced by up/down counters. The dynamic range of the resulting transformation can be increased by the use of adaptive delta modulation.

54410 (ANL-90/28) **Theory Institute in Automated Reasoning held at Argonne National Laboratory, August 6-10, 1990.** Wos, L. Argonne National Lab., IL (USA). Aug 1990. 8p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. Order Number DE91001097. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

On August 6-10, 1990, Argonne National Laboratory hosted a Theory Institute in Automated Reasoning. The institute was organized by the Mathematics and Computer Science Division and was supported by special funding from Argonne's Physical Research Program Administration. The focus of the Institute was on the obstacles confronting the effective automation of reasoning. The objective was to lay the groundwork for formulating a theory governing the interrelationship of representation, inference rule, and strategy. Here we summarize the activities that took place during the week-long Institute. We also present an evaluation of the progress achieved-progress that includes the solution of challenge questions, the increasing use of both our database of problems and our automated reasoning program OTTER, and the discovery of new used for OTTER. 7 refs.

54411 (ANL-90/30) **A tutorial on the construction of high-performance resolution/paramodulation systems.** Butler, R.; Overbeek, R. Argonne National Lab., IL (USA). Sep 1990. 70p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. Order Number DE91001096. Source: NTIS, PC A04/MF A01 - OSTI; GPO Dep.

Over the past 25 years, researchers have written numerous deduction systems based on resolution and paramodulation. Of these systems, a very few have been capable of generating and maintaining a "formula database" containing more than just a few thousand clauses. These few systems were used to explore mechanisms for rapidly extracting limited subsets of "relevant" clauses. We have written this tutorial to reflect some of the best ideas that have emerged and to cast them in a form that makes them easily

accessible to students wishing to write their own high-performance systems. 4 refs.

54412 (ANL/EAIS/TM–27) **Case study of verification, validation, and testing in the Automated Data Processing (ADP) system development life cycle.** Riemer, C.A. Argonne National Lab., IL (USA). Environmental Assessment and Information Sciences Div. May 1990. 75p. Sponsored by U.S. Department of Veterans Affairs. DOE Contract W-31109-ENG-38. Order Number DE91001271. Source: NTIS, PC A04/MF A01 - OSTI; GPO Dep.

Staff of the Environmental Assessment and Information Sciences Division of Argonne National Laboratory (ANL) studies the role played by the organizational participants in the Department of Veterans Affairs (VA) that conduct verification, validation, and testing (VV&T) activities at various stages in the automated data processing (ADP) system development life cycle (SDLC). A case-study methodology was used to assess the effectiveness of VV&T activities (tasks) and products (inputs and outputs). The case selected for the study was a project designed to interface the compensation and pension (C&P) benefits systems with the centralized accounts receivable system (CARS). Argonne developed an organizational SDLC VV&T model and checklists to help collect information from C&P/CARS participants on VV&T procedures and activities, and these were then evaluated against VV&T standards.

54413 (BNL–45180) **Parallel multilevel preconditioners.** Bramble, J.H.; Pasciak, J.E.; Xu, Jinchao. Brookhaven National Lab., Upton, NY (USA). [1989]. 17p. Sponsored by U.S. Department of Defense; U.S. DOE Energy Research; National Science Foundation. DOE Contract AC02-76CH00016. Grant DMS 84-05352. (CONF-8807172–2: 10. Dundee conference on differential equations; 3. Society for Industrial and Applied Mathematics (SIAM) conference on domain decomposition methods, Dundee (UK); Houston, TX (USA), 4-8 Jul 1988; 20-22 mar 1989; CONF-8903169–4). Order Number DE91001121. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

In this paper, we shall report on some techniques for the development of preconditioners for the discrete systems which arise in the approximation of solutions to elliptic boundary value problems. Here we shall only state the resulting theorems. It has been demonstrated that preconditioned iteration techniques often lead to the most computationally effective algorithms for the solution of the large algebraic systems corresponding to boundary value problems in two and three dimensional Euclidean space. The use of preconditioned iteration will become even more important on computers with parallel architecture. This paper discusses an approach for developing completely parallel multilevel preconditioners. In order to illustrate the resulting algorithms, we shall describe the simplest application of the technique to a model elliptic problem.

54414 (BNL–45230) **Decoupling with stability for a class of right invertible systems.** Zhang, Wu (Brookhaven National Lab., Upton, NY (USA)); Chen, Chi-Tsong. Brookhaven National Lab., Upton, NY (USA). [1990]. 2p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. (CONF-901209–6: 29. IEEE conference on decision and control, Honolulu, HI (USA), 5-7 Dec 1990). Order Number DE91000902. Source: NTIS, PC A01/MF A01 - OSTI; GPO Dep.

In this paper, we extend the result of to ensure the stability of the decoupled systems. Furthermore, we derive a design algorithm of static state feedback decoupling with arbitrary pole assignment. Consider a system described by a q × p proper rational transfer function matrix $G(s) = N(s)D^{-1}(s)$, where N(s) and D(s) are right coprime polynomial matrices, and D(s) is column reduced with column degree μ_i, for i = 1, 2,···,p. Let x be the corresponding state vector of a minimum realization (A, B, C, E) of the system. Let the constant matrices (H, K) be the static state feedback compensator pair. Then the overall system transfer function matrix is $G_f(s) = (C + EK)[sI - A - BK]^{-1}BH + EH$, and the corresponding open loop compensator T(s) can be written as $T(s) = [I - K(sI - A)^{-1}B]^{-1}H$.

54415 (CDTN–ASPC.CN-001/89, pp. 262-266) **Semi-annual report of the Computational Division of CDTN - July to December 1988.** Silva, J.G.R. da. Centro de Desenvolvimento da Tecnologia Nuclear (CDTN), Belo Horizonte, MG (Brazil). 1989. (In Portuguese). In *Semi-annual report of Nuclear Technology and Development Center (CDTN) - July to December 1988.* 353p. Order Number DE91606188. Source: NTIS (US Sales Only), PC A16/MF A01; OSTI; INIS.

The main activities developed by the Computational Division in the area of nuclear code implantation are described. (E.G.).

54416 (CONF-901209–1) **A two-sided game for competitive systems with non-local interactions.** Lenhart, S. (Oak Ridge National Lab., TN (USA)); Protopopescu, V.; Stojanovic, S. Oak Ridge National Lab., TN (USA). [1990]. 7p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From 29. IEEE conference on decision and control; Honolulu, HI (USA); 5-7 Dec 1990. Order Number DE90008490. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

We consider a system of two stationary semilinear elliptic partial differential equations with rather general competitive interactions. These reaction-diffusion systems occur frequently as mathematical representations of chemical, biological, ecological, or military situations. Our motivation is related to possible applications to competitive/conflict situations and, in particular, to classical warfare for which systems of this type have been applied with rather promising results. Specifically, we consider the competitive system as a two-person zero-sum game. Each competitor (player) has certain control on some parameters of the system that represents his levers of action and will eventually determine the outcome of the game. An optimal strategy is to be defined by each player (competitor) in order to ensure his victory. The optimal strategies, mathematically defined in terms of minimizing or maximizing a certain function, are realized by varying the control functions. The purpose of this paper is to show that a unique saddle point exists and is represented by the solution of the optimality system. The optimality system consists of two elliptic PDE state equations coupled with two adjoint equations. 11 refs.

54417 (DOE/ER/14079–4) **Compensating finite-difference errors in 3-D migration and modeling.** Li, Zhiming. Colorado School of Mines, Golden, CO (USA). Center for Wave Phenomena. Sep 1990. 27p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-89ER14079. (CWP–099). Order Number DE91001447. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

One-pass three-dimensional (3-D) depth migration potentially offers more accurate imaging results than does conventional two-pass migration, in variable velocity media. Conventional one-pass 3-D migration, done with the method of finite-difference inline and crossline splitting, however, creates large errors in imaging complex structures due to paraxial wave-equation approximation of the one-way wave equation, inline-crossline splitting, and finite-difference grid dispersion. After analyzing the finite-difference errors in conventional 3-D poststack wave field extrapolation, the paper presents a method that compensates for the errors and yet still preserves the efficiency of the conventional finite-difference splitting method. For frequency-space 3-D finite-difference migration and modeling, the compensation operator is implemented using the phase-shift method, or phase-shift plus interpolation method, depending on the extent of lateral velocity variations. The compensation operator increases the accuracy of handling steep dips, suppresses the inline and crossline splitting error, and reduces finite-difference grid dispersions. Numerical calculations show that the quality of 3-D migration and 3-D modeling is improved significantly with the finite-difference error compensation method presented in this paper. 13 refs., 7 figs.

54418 (DOE/ER/25045–T3) **Parallel algorithms for stochastic linear programs: A summary of research performed.** Ariyawansa, K.A. Washington State Univ., Pullman, WA (USA). Dept. of Pure and Applied Mathematics. 1988. 103p. Sponsored by U.S. DOE Energy Research. DOE Contract FG06-87ER25045. Order Number DE91001306. Source: NTIS, PC A06/MF A01 - OSTI; GPO Dep.

This report contains papers on parallel algorithms used in linear programs. (LSP)

54419 **1989 lectures in complex systems: Proceedings: Lectures, Volume 2.** Santa Fe Institute studies in the sciences of complexity. Jen, E. (ed.) (Los Alamos National Lab., NM (USA)).

617p. Addison-Wesley Publishing Company, Redwood City, CA (1990). DOE Contract FG05-89ER25075. (CONF-8906239–Vol.2: 1989 complex systems summer school, Santa Fe, NM (USA), 5-30 Jun 1989).

This report contains papers on the following topics: Lectures on a Theory of Computation and Complexity over the Reals; Algorithmic Information Content, Church-Turing Thesis, Physical Entroph, and Maxwell's Demon; Physical Measures of Complexity; An Introduction to Chaos and Prediction; Hamiltonian Chaos in Nonlinear Polarized Optical Beam; Chemical Oscillators and Nonlinear Chemical Dynamics; Isotropic Navier-Stokes Turbulence. I. Qualitative Features and Basic Equations; Isotropic Navier-Stokes Turbulence. II. Statistical Approximation Methods; Lattice Gases; Data-Parallel Computation and the Connection Machine; Preimages and Forecasting for Cellular Automata; Lattice-Gas Models for Multiphase Flows and Magnetohydrodynamics; Probabilistic Cellular Automata: Some Statistical Mechanical Considerations; Complexity Due to Disorder and Frustration; Self-Organization by Simulated Evolution; Theoretical Immunology; Morphogenesis by Cell Intercalation; and Theoretical Physics Meets Experimental Neurobiology.

54420 (IAEA-NDS–39(Rev.5)) **The 1989 ENDF preprocessing codes.** Cullen, D.E. (Lawrence Livermore National Lab., CA (USA)); McLaughlin, P.K. International Atomic Energy Agency, Vienna (Austria). Nuclear Data Section. Dec 1989. 140p. Order Number DE91602684. Source: NTIS (US Sales Only), PC A07/MF A01; OSTI; INIS.

This document summarizes the 1989 version of the ENDF preprocessing codes which are required for processing evaluated nuclear data coded in the format ENDF-4, ENDF-5, or ENDF-6. The codes are available from the IAEA Nuclear Data Section, free of charge upon request. (author).

54421 (LA–11916-MS) **Mesh considerations for finite element structural dynamic applications.** Stevens, R.R. Los Alamos National Lab., NM (USA). Nov 1990. 24p. Sponsored by U.S. Department of Defense. DOE Contract W-7405-ENG-36. Order Number DE91001717. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Three factors relating to a finite element mesh and discretization scheme are discussed: the geometric accuracy of the node locations, the amount of warp of a quadrilateral shell element, and the directional biasing effect of similarly oriented triangular elements. These factors can have a significant effect on the accuracy of a finite element structural dynamic analysis. Two finite element models that illustrate these effects are described.

54422 (LNCC–004/90) **Gamat2 - program for automatic mesh generation of linear and quadratic triangular finite elements.** Guimaraes, A.C.S.; Feijoo, R.A. Laboratorio Nacional de Computacao Cientifica (LNCC), Rio de Janeiro, RJ (Brazil). Feb 1990. 16p. (In Portuguese). Order Number DE91606187. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

The program GAMAT2 for automatic 2-dimensional mesh generation of linear and quadratic triangular finite elements is presented in this paper. (author).

54423 (ORNL/TM–11130) **PICL: A portable instrumented communication library, C reference manual.** Geist, G.A.; Heath, M.T.; Peyton, B.W.; Worley, P.H. Oak Ridge National Lab., TN (USA). Jul 1990. 149p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE91001014. Source: NTIS, PC A07/MF A01 - OSTI; GPO Dep.

PICL is a subroutine library that can be used to develop parallel programs that are portable across several distributed memory multiprocessors. The library provides portable syntax for the key communication primitives and related system calls required to program these machines It also provides portable routines to perform certain widely-used, high-level communication operations, such as global broadcast and global sum. Finally, the library provides an execution tracing facility that can be used to monitor performance or to aid in debugging. This report is the PICL reference manual for C programmers. It contains full descriptions of all PICL routines as well as explanations on how to use the routines to write a parallel program. A short users' guide to PICL containing examples of how to use it is available as a separate report.

54424 (ORNL/TM–11496) **A compute-ahead implementation of the fan-in sparse distributed factorization scheme.** Ashcraft, C. (Yale Univ., New Haven, CT (USA). Dept. of Computer Science); Eisenstat, S.C.; Sherman, A.H.; Liu, J.W.H.; Peyton, B.W. Oak Ridge National Lab., TN (USA). Aug 1990. 21p. Sponsored by U.S. Department of Defense; U.S. DOE Energy Research; National Science Foundation. DOE Contract AC05-84OR21400. Contract N00014-86-K-0310;Contract N00014-89-J-1906;Grant DCR-85 (CONF-9006260–1: 4. Canadian supercomputing symposium, Montreal (Canada), 4-6 Jun 1990). Order Number DE91000531. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

In this report, we consider a compute-ahead computational technique in the distributed factorization of large sparse matrices using the fan-in parallel scheme. Experimental results on an Intel iPSC/2 hypercube are provided to demonstrate the relevance and effectiveness of this technique. Fortran source code is also included in an appendix. 9 refs., 2 figs., 1 tab.

54425 (ORNL/TM–11634) **Synthetic models of distributed memory parallel programs.** Poplawski, D.A. (Michigan Technological Univ., Houghton, MI (USA). Dept. of Computer Science). Oak Ridge National Lab., TN (USA). Sep 1990. 38p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE91001058. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This paper deals with the construction and use of simple synthetic programs that model the behavior of more complex, real parallel programs. Synthetic programs can be used in many ways: to construct an easily ported suite of benchmark programs, to experiment with alternate parallel implementations of a program without actually writing them, and to predict the behavior and performance of an algorithm on a new or hypothetical machine. Synthetic programs are constructed easily from scratch, from existing programs, and can even be constructed using nothing but information obtained from traces of the real program's execution.

54426 (ORNL/TM–11639) **SQTTEXT: A tool for editing Structured Query Language (SQL) text within ORACLE SQL*Forms applications.** Daugherty, P.F.; Singley, P.T. Oak Ridge National Lab., TN (USA). Aug 1990. 36p. Sponsored by U.S. Department of Defense. DOE Contract AC05-84OR21400. Order Number DE91000534. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

SQTTEXT is an ORACLE SQL*Forms application that allows a programmer to view and edit all the Structured Query Language (SQL) text for a given application on one screen. This application is an outgrowth of the prototyping of an on-line system dictionary for the Worldwide Household Goods Information System for Transportation-Modernization decision support system being prototyped by the Oak Ridge National Laboratory, but it can be applied to all SQL*Forms software development, debugging, and maintenance. The system dictionary and SQTTEXT were written in version 2.3 of ORACLE's application generator, SQL*Forms. SQL*Forms greatly simplifies users' access to ORACLE databases, but the design of the tool should be friendlier to those programming, debugging, and maintaining SQL*Forms applications. Because SQL*Forms version 2.3 forces the programmer to view each component of a program through a window specific to that component, it is impossible to get an overview of the whole application at one time. The SQTTEXT application allows experienced ORACLE programmers to increase their productivity by allowing access to all Structured Query Language (SQL) text within a SQL*Forms application via one screen. The SQTTEXT application is based on the eight ORACLE Integrated Application Processor (IAP) tables that store information about SQL*Forms applications. The SQTTEXT application displays the trigger level, trigger name, and SQL text associated with triggers, and also displays block names, base table names, and the SQL text for WHERE/ORDER BY clauses. This report provides a step-by-step explanation of how to use SQTTEXT, descriptions of the IAP tables, and a listing of the SQTTEXT code.

54427 (SAND–90-1968) **NIRVANA network requirements.** Wood, B.J. Sandia National Labs., Albuquerque, NM (USA). Aug 1990. 22p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. Order Number DE91000465. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

NIRVANA is an effort to standardize electrical computer-aided design workstations at Sandia National Laboratories in Albuquerque, New Mexico. The early effect of this project will be the introduction of at least 60 new engineering workstations at Sandia National Laboratories. Albuquerque, and at Allied Signal, Kansas City Division. These workstations are expected to begin arriving in September 1990. This paper proposes a design and outlines the requirements for a network to support the NIRVANA project. The author proposes a near-term network design, describes the security profile and caveats of this design, and proposes a long-term networking strategy for NIRVANA. 6 refs., 7 figs.

54428 (SAND–90-2387C) **Design of strictly positive real, fixed-order dynamic compensators.** Jacobus, M. (Sandia National Labs., Albuquerque, NM (USA)); Jamshidi, M.; Abdallah, C.; Dorato, P. Sandia National Labs., Albuquerque, NM (USA). [1990]. 4p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-901209–3: 29. IEEE conference on decision and control, Honolulu, HI (USA), 5-7 Dec 1990). Order Number DE90017589. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

This paper presents sufficient conditions for the design of strictly positive real (SPR), fixed-order dynamic compensators. The primary motivation for designing SPR compensators is for application to positive real (PR) plants. When an SPR compensator is connected to a PR plant in a negative feedback configuration, the closed loop is guaranteed stable for arbitrary plant variations as long as the plant remains PR. This paper gives equations that are a modified form of the optimal projection equations, with the separation principle not holding in either the full- or reduced-order case. A solution to the design equations is shown to exist when the plant is PR (or just stable). Finally, the closed loop system consisting of a PR plant and an SPR compensator is shown to be S-structured Lyapunov stable. 7 refs.

54429 (SOL–90-14) **Covers by polars of arrangements.** Eaves, B.C. (Stanford Univ., CA (USA). Systems Optimization Lab.); Hoffman, A.J. Stanford Univ., CA (USA). Systems Optimization Lab. Aug 1990. 28p. Sponsored by U.S. Department of Defense; U.S. DOE Energy Research; National Science Foundation. DOE Contract FG03-87ER25028. Order Number DE91001358. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

For a collection of hyperplanes passing through the origin in euclidean space let S be the induced subdivision. Let T be the collection of polars of the full cells of S. If only the origin lies in all hyperplanes, T forms a $\kappa \sim$ fold cover of euclidean space. If, in addition, the collection of hyperplanes is of size m and is regular, then κ is m – 1 choose n – 1. Other similar results relate to spheres, hemispheres, and linear programming.

54430 (SOL–90-15) **A discounted-cost continuous-time flexible manufacturing and operator scheduling model solved by deconvexification over time.** Eaves, B.C.; Rothblum, U.G. Stanford Univ., CA (USA). Systems Optimization Lab. Aug 1990. 52p. Sponsored by U.S. Department of Defense; U.S. DOE Energy Research; National Science Foundation. DOE Contract FG03-87ER25028. Grant DMS-8902662. Order Number DE91001359. Source: NTIS, PC A04/MF A01 - OSTI; GPO Dep.

A discounted-cost, continuous-time, infinite-horizon version of a flexible manufacturing and operator scheduling model is solved. The solution procedure is to convexify the discrete operator-assignment constraints to obtain a linear program, and then to regain the discreteness and obtain an approximate manufacturing schedule by deconvexification of the solution of the linear program over time. The strong features of the model are the accommodation of linear inequality relations among the manufacturing activities and the discrete manufacturing scheduling, whereas the weak features are intra-period relaxation of inventory availability constraints, and the absence of inventory costs, setup times, and setup charges.

54431 (UCRL-ID–103432) **APTBLIBE: Geometrical and Monte Carlo sampling subroutines for the Cray computers.** Edwards, A.L. Lawrence Livermore National Lab., CA (USA). 4 Apr 1990. 130p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. Order Number DE91000498. Source: NTIS, PC A07/MF A01 - OSTI; GPO Dep.

APTBLIBE is a new BUILD library of about 151 Cray-compiled binary subroutines for numerical geometry and Monte Carlo sampling, of which 93 are described here (the rest will be described in a revision). It is designed especially to support 2-D and 3-D codes that generate and track beams or particles of energy or matter (APT = All-Particle-Tracking). The LIB library APTSLIBE contains the FORTRAN source files, and the user document APTDOC, much of which can be updated directly from the source files. This document describes APTBLIBE and its subroutines, how to use them, and the features designed to simplify the development of new codes, and improve the speed, efficiency, reliability and ease of maintenance of any codes which make use of it.

54432 (UCRL-ID–106077) **An information-theoretic look at branch-prediction.** Ponder, C.G. (Lawrence Livermore National Lab., CA (USA)); Shebanow, M.C. Lawrence Livermore National Lab., CA (USA). 11 Sep 1990. 32p. Sponsored by U.S. Department of Defense; U.S. DOE Energy Research; National Science Foundation. DOE Contract W-7405-ENG-48. Grant CCR-8812843 Grant DAAG29-85-K-0070 Contract N00039-84-;C-0 Order Number DE91000499. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Accurate branch-prediction is necessary to utilize deeply pipelined and Very Long Instruction-Word (VLIW) architectures. For a set of program traces we show the upper limits on branch predictability, and hence machine utilization, for important classes of branch-predictors using static (compiletime) and dynamic (runtime) program information. A set of optimal "superpredictors" is derived from these program traces. These optimal predictors compare favorably with other proposed methods of branch-prediction. 3 refs., 5 figs., 12 tabs.

54433 (UCRL-JC–103754) **Tools for reverse engineering existing systems.** Zucconi, L. Lawrence Livermore National Lab., CA (USA). 17 Apr 1990. 5p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-901213–1: CASE '90: 4th international workshop on computer-aided software engineering, Irvine, CA (USA), 5-8 Dec 1990). Order Number DE90010655. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Short communication. COMPUTER-AIDED DESIGN; ENGINEERING; COMPUTER ARCHITECTURE

54434 (UCRL-JC–103980) **SISAL 1.2: High-performance applicative computing.** Cann, D.C.; Feo, J.T.; DeBoni, T.M. Lawrence Livermore National Lab., CA (USA). May 1990. 19p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-48. (CONF-901221–1: 2. IEEE symposium on parallel and distributed processing, Dallas, TX (USA), 9-13 Dec 1990). Order Number DE90011461. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The acquisition of parallel processors in the scientific community is increasing, but the difficulties of parallel programming persist. Three approaches have emerged: automatic parallelizing compilers for extant languages, extended languages, and new languages that provide a cleaner and easier-to-use parallel programming model. One such new language is SISAL 1.2[13], a general-purpose applicative language. Regrettably, applicative languages have acquired a reputation for inefficiency because of their single-assignment semantics, and dynamic creation of aggregate objects. We show that a set of powerful yet simple optimization techniques can reduce the overhead of applicative semantics without sacrificing parallelism. Optimized SISAL codes can achieve execution speeds comparable to FORTRAN, and effectively exploit shared-memory multiprocessors. 22 refs.

54435 (UCRL-JC–104151) **Area and volume coherence for efficient visualization of 3D scalar functions.** Max, N. (Lawrence Livermore National Lab., CA (USA)); Hanrahan, P.; Crawfis, R. Lawrence Livermore National Lab., CA (USA). [1990]. 21p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-901224–1: San Diego workshop on volume visualization, San Diego, CA (USA), 10-11 Dec 1990). Order Number DE90012994. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

We present an algorithm for compositing a combination of density clouds and contour surfaces used to represent a scalar function on a 3-D volume. The volume is divided into convex polyhedra, at

whose vertices the function is known, and the polyhedra are sorted in depth before compositing. For data given at scattered 3-D points, we show that this sorting can be done in O(n) time if we chose the tetrahedra in the Delaunay triangulation as the polyhedra. The integrals for cloud opacity and visible cloud intensity along a ray through a convex polyhedron are computed analytically, and this computation is coherent across the polyhedron's area. 33 refs.

54436 (UCRL-JC-104360) **ASSESS [Analytic System and Software for Evaluating Safeguards and Security] update: Current status and future developments.** Al-Ayat, R.A. (Lawrence Livermore National Lab., CA (USA)); Cousins, T.D.; Hoover, E.R. Lawrence Livermore National Lab., CA (USA). 15 Jul 1990. 9p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48 ;AC04-76DP00789. (CONF-9007106--76: Institute of nuclear materials management conference, Los Angeles, CA (USA), 15-18 Jul 1990). Order Number DE91001765. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The Analytic System and Software for Evaluating Safeguards and Security (ASSESS) has been released for use by DOE field offices and their contractors. In October, 1989, we offered a prototype workshop to selected representatives of the DOE community. Based on the prototype results, we held the first training workshop at the Central Training Academy in January, 1990. Four additional workshops are scheduled for FY 1990. ASSESS is a state-of-the-art analytical tool for management to conduct integrated evaluation of safeguards systems at facilities handling facilities. Currently, ASSESS focuses on the threat of theft/diversion of special nuclear material by insiders, outsiders, and a special form of insider/outsider collusion. ASSESS also includes a neutralization module. Development of the tool is continuing. Plans are underway to expand the capabilities of ASSESS to evaluate against violent insiders, to validate the databases, to expand the neutralization module, and to assist in demonstrating compliance with DOE Material Control and Accountability (MC&A) Order 5633.3. These new capabilities include the ability to: compute a weighted average for performance capability against a spectrum of insider adversaries; conduct defense-in-depth analyses; and analyze against protracted theft scenarios. As they become available, these capabilities will be incorporated in our training program. ASSESS is being developed jointly by Lawrence Livermore and Sandia National Laboratories under the sponsorship of the Department of Energy (DOE) Office of Safeguards and Security.

54437 (UCRL-JC-104926) **Projected implicit Runge-Kutta methods for differential-algebraic boundary value problems.** Ascher, U. (British Columbia Univ., Vancouver, BC (Canada)); Petzoid, L. Lawrence Livermore National Lab., CA (USA). Sep 1990. 9p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-48. (CONF-901209-5: 29. IEEE conference on decision and control, Honolulu, HI (USA), 5-7 Dec 1990). Order Number DE91000660. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Differential-algebraic boundary value problems arise in the modelling of singular optimal control problems and in parameter estimation for singular systems. A new class of numerical methods for these problems is introduced, and shown to overcome difficulties with previously defined numerical methods. 4 refs., 1 tab.

54438 (WHC-SA-0832) **Hanford general employee training: Computer-based training instructor's manual: Version 1.0.** Westinghouse Hanford Co., Richland, WA (USA). Oct 1990. 63p. Sponsored by U.S. DOE Office of Administration and Human Resource Management. DOE Contract AC06-87RL10930. (CONF-9002155--1: TRADE special interest group advanced training technologies meeting, Orlando, FL (USA), 16 Feb 1990). Order Number DE91001280. Source: NTIS, PC A04/MF A01 - OSTI; GPO Dep.

The Computer-Based Training portion of the Hanford General Employee Training course is designed to be used in a classroom setting with a live instructor. Future references to this "course" refer only to the computer-based portion of the whole. This course covers the basic Safety, Security, and Quality issues that pertain to all employees of Westinghouse Hanford Company. The topics that are covered were taken from the recommendations and requirements for General Employee Training as set forth by the Institute of Nuclear Power Operations (INPO) in INPO 87-004, Guidelines for General Employee Training, applicable US Department of Energy orders, and Westinghouse Hanford Company procedures and policy. Besides presenting fundamental concepts, this course also contains information on resources that are available to assist students. It does this using Interactive Videodisk technology, which combines computer-generated text and graphics with audio and video provided by a videodisk player.

54439 Linear optimization - A case study in performance analysis. Stunkel, C.B. (Illinois Univ., Urbana (USA)); Fuchs, W.K.; Rudolph, D.C.; Reed, D.A. pp. 4 of DOE, conference on hypercubes, concurrent computers and applications. Illinois Univ., Urbana, IL (US) (1989). vp. of (CONF-890372--: 4. hypercube, concurrent computers and applications, Monterey, CA (USA), 6-8 Mar 1989).

The paper deals with the performance of two parallel variants of the simplex algorithm on a message-passing system. First, the simplex algorithm is reviewed, two possible parallelizations of the algorithm are discussed, and results of benchmark speedups of the alternatives are presented. Between column and row partitionings, the row partitioning method is found to be generally superior, while the column partitioning method is more efficient when the number of rows is small, and the number of columns is much greater that the number of rows. Various performance analysis tools are then applied to examine the reasons for relative performance differences, and communication idle time due to global minimization and load imbalances is noted as the main factor in execution slowdown. 5 refs.

54440 Performance of various computers using standard linear equations software in a Fortran environment. Dongarra, J.J. (Argonne National Lab., IL (USA). Mathematics and Computer Science Div.). pp. 151-182 of Multiprocessors and array processors: Simulation series. Volume 21, Number 1. Karplus, W.J. Society for Computer Simulation, San Diego, CA (USA) (1989). pp. 187 DOE Contract W-31-109-ENG-38. (CONF-8903234--: 5. conference on multiprocessors and array processors, Tampa, FL (USA), 28-31 Mar 1989).

This paper compares the performance of different computer systems while solving dense systems of linear equations using the LINPACK software in a Fortran environment. About 100 computers, ranging from a CRAY X-MP to the 68000 based systems such as the Apollo and SUN Workstations to IBM PC's, are compared. The timing information presented should in no way be used to judge the overall performance of a computer system. The results reflect only one problem area: solving dense systems of equations using the LINPACK programs in a Fortran environment.

54441 Design and implementation of multi-sensor fusion algorithm on a hypercube computer architecture. Glover, C.W. (Oak Ridge National Lab., TN (USA)). pp. 286-300 of Sensor Fusion II: Human and machine strategies: Volume 1198. Schenker, P.S. Society of Photo-Optical Instrumentation Engineers, Bellingham, WA (USA) (1989). pp. 600 (CONF-8911186--: International Society for Optical Engineering meeting, Philadelphia, PA (USA), 6-10 Nov 1989).

A multi-sensor integration (MSI) algorithm written for sequential single processor computer architecture has been transformed into a concurrent algorithm and implemented in parallel on a multiprocessor hypercube computer architecture. This paper presents the philosophy and methodologies used in the decomposition of the sequential MSI algorithm, and its transformation into a parallel MSI algorithm. The parallel MSI algorithm was implemented on a NCUBE hypercube computer. The performance of the parallel MSI algorithm has been measured and compared against its sequential counterpart by running test case scenarios through a simulation program.

54442 Design and implementation of two concurrent multi-sensor integration algorithms for mobile robots. Jones, J.P. (Oak Ridge National Lab., TN (USA). Center for Engineering Systems Advanced Research); Beckerman, M.; Mann, R.C. pp. 301-312 of Sensor Fusion II: Human and machine strategies: Volume 1198. Schenker, P.S. Society of Photo-Optical Instrumentation

Engineers, Bellingham, WA (USA) (1989). pp. 600 (CONF-8911186--: International Society for Optical Engineering meeting, Philadelphia, PA (USA), 6-10 Nov 1989).

Two multi-sensor integration algorithms useful in mobile robotics applications are reviewed. A minimal set of utilities are then developed which enable implementation of these algorithms on a distributed memory concurrent computer.

54443 Multichannel signal enhancement. Lewis, P.S. To Dept. of Energy, Washington, DC (USA). USA Patent 4,947,480/A/. 7 Aug 1990. Filed date 31 Oct 1988. USA Patent patents application 7-264,722. Int. Cl. G06F 7/38. 7p. Source: Patent and Trademark Office, Box 9, Washington, DC 20232 (USA).

This patent describes a mixed adaptive filter is formulated for the signal processing problem where desired a priori signal information is not available. The formulation generates a least squares problem which enables the filter output to be calculated directly from an input data matrix. In one embodiment, a folded processor array enables bidirectional data flow to solve the recursive problem by back substitution without global communications. In another embodiment, a balanced processor array solves the recursive problem by forward elimination through the array. In a particular application to magnetoenceph-alography, the mixed adaptive filter enables an evoked response to an auditory stimulus to be identified from only a single trial.

9903 Information Handling

Refer also to citation(s) 52805, 52812, 52929, 53056, 53700, 54271, 54402, 54403, 54404, 54405, 54406, 54407, 54411, 54412, 54426

54444 (ANL/EAIS/TM-26) **Cost-benefit study of culling claim folders at the Department of Veterans Affairs.** Charles, P.; Hill, L.G.; Johnson, P.; Riemer, C.A. Argonne National Lab., IL (USA). Environmental Assessment and Information Sciences Div. Apr 1990. 74p. Sponsored by U.S. Department of Veterans Affairs. DOE Contract W-31109-ENG-38. Order Number DE91001035. Source: NTIS, PC A04/MF A01 - OSTI; GPO Dep.

Culling is the process of sorting through material to separate significant from insignificant information. Argonne National Laboratory (ANL) conducted a study on culling Veterans Benefits Administration (VBA) claim folders for two reasons. The first was to help the Department of Veterans Affairs (VA) learn about culling strategies that could be applied to veterans' claim folders located at the VA's regional offices (ROs) throughout the United States. The second was to show the VA the benefits that could be derived from culling. 24 tabs.

54445 (ORNL/TM-11287-Rev.1) **Maintenance Information and Data Acquisition System (MIDAS): Revision 1.** Stansberry, C.T.; Odom, S.M.; Martin, C.D.; Grubbs, G.F. Oak Ridge National Lab., TN (USA). Sep 1989. 222p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE91001315. Source: NTIS, PC A10/MF A01 - OSTI; GPO Dep.

The Maintenance Information Data Acquisition System (MIDAS) is an innovative program to combine new and existing programs into one unique system that allows quick response to a wide range of management information programs, leading to more effective administration of the Maintenance Management Department of the Instrumentation and Controls Division at Oak Ridge National Laboratory. The goal of this system is to provide rapid access to broad areas of management programs as easily as possible. Doing so with the touch of a single computer key thus lives up to the Midas legend, the "Golden Touch."

54446 (ORNL/TM-11583) **A case study in specifying data requirements for a decision support system database.** Ng, V. Oak Ridge National Lab., TN (USA). Aug 1990. 65p. Sponsored by U.S. Department of Defense. DOE Contract AC05-84OR21400. Order Number DE91001006. Source: NTIS, PC A04/MF A01 - OSTI; GPO Dep.

An atomic database is a collection of detailed and archival data primarily used to support a decision support system (DSS). Typically, atomic data are generated externally from other sources. In order to build an atomic data base in which data represent the information the DSS users expect, detailed data requirements must be specified to the source system. The basic types of information a source system needs are a list of required data items, the frequency and terms of data needs, and the method of interface. A detailed list of required items recommended for inclusion in any specifications of external data requirements is presented in this paper. Because of the volume of information involved in such specifications, a matrix presentation is believed to be the best organizational format to describe the requirements concisely and precisely. The specifications of external data requirements written for the Worldwide Household Goods Information System for Transportation Modernization (WHIST-MOD) project for the Personal Property Directorate (MTPP) of the Military Traffic Management Command (MTMC) are presented as a case study in this paper. It has been shown that the specifications in this case study effectively serve the objective of such a document. It is recommended that the concept presented in this paper be used as a guideline in specifying data requirements for an atomic database. 5 refs., 2 figs.

54447 (ORNL/TM-11595) **A technical description of enhancements to the front-end user interface for the Worldwide Household Goods Information System for Transportation Modernization (WHIST-MOD).** Loftis, J.P. (Oak Ridge National Lab., TN (USA)); Spears, P.M.; James, T.L. Oak Ridge National Lab., TN (USA). Aug 1990. 75p. Sponsored by U.S. Department of Defense. DOE Contract AC05-84OR21400. Order Number DE91001024. Source: NTIS, PC A04/MF A01 - OSTI; GPO Dep.

The Directorate of Personal Property of the Military Traffic Management Command (MTMC) asked Oak Ridge National Laboratory (ORNL) to design a decision support system, the Worldwide Household Goods Information System for Transportation Modernization. This decision support system will automate tasks and provide analysis tools for evaluating the Personal Property Program, predicting impacts to the program, and planning modifications to the program to meet the evolving needs of military service members and the transportation industry. The system designed by ORNL consists of three application modules: system dictionary applications, data acquisition and administration applications, and user applications. The user applications module is divided into two phases: the data selection front-end interface and the postprocessing back-end interface. This paper describes the prototyped front-end interface using ORACLE SQL*Forms, part of the ORACLE Relational Database Management System (RDBMS) toolset. The focus of this paper is a discussion of the need for enhancements to the initial design of the interface and the coding techniques used to prototype the enhancements. These enhancements make the front-end interface more flexible and easier to use by giving users options for identifying data to be used by the back-end interface. This report is based on in-depth interviews of MTMC staff, prototype meetings with the users, and the research and design work conducted at ORNL.

54448 (SAND-90-2388C) **Certified records manager exam.** Sandia National Labs., Albuquerque, NM (USA). [1990]. 12p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-9008145-3: 1990 Nuclear Information Records Management Association symposium, Dallas, TX (USA), 25 Aug 1990). Order Number DE91000969. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The Institute of Certified Records Managers (ICRM) is a nonprofit, certifying organization of professional records managers and administrators. ICRM members are experienced in information requirements, records and information systems, and the related office systems and technologies. All members have met certification requirements and have received the Certified Records Manager (CRM) designation. As the field of information and records management moves toward standardization, and as the application of new technologies and technicalities complicate the measurement and demonstration of professional competence, the need for a means of identifying persons who have basic competency increases. The ICRM is providing such a means by testing and certifying basic knowledge. More and more job announcements are requiring this evidence of competency. Unfortunately, as an organization, NIRMA has a relatively small number of CRMs. The goal of the ICRM Development Group is two-fold; (1) to encourage NIRMA

members to obtain their certification by providing basic information and support and; (2) to develop the Nuclear Specialist test module which will demonstrate that bearers have demonstrated expertise in nuclear records management as well as basic competencies. This report covers the examination process.

54449 (SAND–90-2389C) **Requirements identification: How do we know what to do?.** Sandia National Labs., Albuquerque, NM (USA). [1990]. 19p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-9008145–2: 1990 Nuclear Information Records Management Association symposium, Dallas, TX (USA), 25 Aug 1990). Order Number DE91000970. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The Nuclear Information and Records Management Association (NIRMA) Task Force on Requirements Identification is currently involved in a four part project. During the course of the next year the Task Force will: (1) identify the generic requirements documents which have common applicability to nuclear utilities and DOE organizations; (2) research the requirements documents to identify individual requirements; (3) develop and implement a PC based tracking system to present and maintain the research data; and (4) implement a process for ongoing review of requirements. This report discusses these issues.

54450 (SAND–90-2589C) **A trellis-searched APC [adaptive predictive coding] speech coder.** Malone, K.T. (Sandia National Labs., Albuquerque, NM (USA)); Fischer, T.R. Sandia National Labs., Albuquerque, NM (USA). [1990]. 11p. Sponsored by U.S. DOE Defense Programs; National Science Foundation. DOE Contract AC04-76DP00789. Grant NCR-8821764. (CONF-9011114–1: 1990 international symposium on information theory and its applications, Honolulu, HI (USA), 27-30 Nov 1990). Order Number DE91000866. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

In this paper we formulate a speech coding system that incorporates trellis coded vector quantization (TCVQ) and adaptive predictive coding (APC). A method for "optimizing" the TCVQ codebooks is presented and experimental results concerning survivor path mergings are reported. Simulation results are given for encoding rates of 16 and 9.6 kbps for a variety of coder parameters. The quality of the encoded speech is deemed excellent at an encoding rate of 16 kbps and very good at 9.6 kbps. 13 refs., 2 figs., 4 tabs.

54451 (UCRL-ID–106075) **Tools for using BibTEX.** Fitch, J.P. Lawrence Livermore National Lab., CA (USA). 2 Oct 1990. 11p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. Order Number DE91000494. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This note describes several computer scripts to assist when using BibTEX to maintain bibliographical databases. One set of routines are used to generate a list of items contained in a BibTEX "bib" file which can then be LATEX'ed for reference and printing. Another set of routines are used to "grep" for bibliographical entries in a "bib" file as well as ordering existing "bib" files alphabetically. The codes are shell scripts which are call awk programs and run on sun (unix) computers.

Corporate Author Index

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	15:53611	DOE/EH/OEV–13P
	15:53612	DOE/EH/OEV–14P
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	15:53614	DOE/EH/OEV–16P
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	15:53616	DOE/EH/OEV–19P
	15:53617	DOE/EH/OEV–20P
	15:53618	DOE/EH/OEV–21P
	15:53619	DOE/EH/OEV–22P
	15:53620	DOE/EH/OEV–23P
	15:53621	DOE/EH/OEV–24P
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	15:53628	DOE/EH/OEV–34P
	15:53629	DOE/EH/OEV–35P
	15:53630	DOE/EH/OEV–38P
	15:53631	DOE/EH/OEV–40P
AC02-76CH00016	**Brookhaven National Lab., Upton, NY (USA)**	
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	15:53274	CONF-891092–
	15:53285	Published article
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AC02-76CH03000	**Fermi National Accelerator Lab., Batavia, IL (USA)**	
	15:53499	FNAL/C–90/174
	15:53978	FNAL/C–90/164-T
	15:53993	FNAL/C–90/163E
	15:53994	FNAL/C–90/166-E
	15:53995	FNAL/C–90/173
	15:53996	FNAL/C–90-187-T
	15:53997	FNAL/C–90/196-T
	15:53998	FNAL/C–90/205-E
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AC02-76CH03073		
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	15:54314	CONF-8905120–
	15:54318	CONF-8905120–
	15:54321	CONF-8905120–
AC02-76ER01198		
	15:53246	Published article
AC02-76ER01338		
	15:53798	Published article
	15:53799	Published article
AC02-76ER03064	**Brookhaven National Lab., Upton, NY (USA)**	
	15:53544	BNL–45262
AC02-76ER03099		
	15:54030	Published article
AC02-76ER03130		
	15:54033	Published article
AC02-76ET51001		
	15:54322	CONF-8905120–
AC02-78ET51013	**Massachusetts Inst. of Tech., Cambridge, MA (USA). Plasma Fusion Center**	
	15:54352	DOE/ET/51013–285
	15:54353	DOE/ET/51013–T231
	15:54300	CONF-8905120–
AC02-80ET17019	**General Electric Co., Schenectady, NY (USA). Advanced Energy Programs Dept.**	
	15:52949	DOE/ET/17019–T3
AC02-81ER10878		
	15:53801	Published article

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AC02-83CH10093	SRI International, Menlo Park, CA (USA)	
	15:52947	SERI/TP-257-3983
	Solar Energy Research Inst., Golden, CO (USA)	
	15:52929	SERI/TP-211-3934
	15:52930	SERI/TP-232-3820
	15:52935	SERI/TP-253-3594
	15:52948	SERI/TR-257-3372
	15:53157	SERI/TP-260-3881
	Sandia National Labs., Albuquerque, NM (USA)	
	15:52937	SAND-90-0903C
	15:53276	CONF-891092-
AC02-83CH10139	Battelle Memorial Inst., Willowbrook, IL (USA). Office of Waste Technology Development	
	15:52790	BMI/OWTD-5
	Battelle, Willowbrook, IL (USA). Office of Waste Technology Development	
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	15:52792	BMI/OWTD-8
AC03-76SF00098	Lawrence Berkeley Lab., CA (USA)	
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	15:53378	LBL-29484
	15:53979	LBL-29405
	15:54360	LBL-29370
	Lawrence Livermore National Lab., CA (USA)	
	15:54225	UCRL-JC-104938
	15:54308	CONF-8905120-
	15:53572	CONF-900143-
	15:52891	Published article
	15:53277	Published article
	15:53285	Published article
	15:53914	Published article
	15:54124	Published article
AC03-76SF00515	Stanford Linear Accelerator Center, Menlo Park, CA (USA)	
	15:53492	SLAC-PUB-5329
	15:53527	SLAC-PUB-5293
	15:53528	SLAC-PUB-5320
	15:53529	SLAC-PUB-5321
	15:53530	SLAC-PUB-5322
	15:53531	SLAC-PUB-5325
AC03-82ER13000		
	15:53272	CONF-891092-
	15:53273	CONF-891092-
AC03-87SF16733		
	15:53287	Published article
AC03-89ER51114	General Atomics, San Diego, CA (USA)	
	15:54271	GA-A-20104
	15:54274	GA-A-20112
	15:54276	GA-A-20181
	15:54354	GA-A-20219
	15:54355	GA-A-20231
	15:54356	GA-A-20238
	15:54357	GA-A-20239
	15:54358	GA-A-20250
	15:54319	CONF-8905120-
AC03-89ER53277	General Atomics, San Diego, CA (USA)	
	15:54272	GA-A-20107
	15:54273	GA-A-20108
	15:54307	CONF-8905120-
AC04-76DP00613	Allied-Signal Aerospace Co., Kansas City, MO (USA). Kansas City Div.	
	15:53307	KCP-613-4253
AC04-76DP00656	General Electric Co., Largo, FL (USA). Neutron Devices Dept.	
	15:53705	DOE/EA-0642
AC04-76DP00789	Sandia National Labs., Albuquerque, NM (USA)	
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	15:54375	SAND-90-2579C-Draft
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	15:54448	SAND-90-2388C
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	15:54450	SAND-90-2589C
	15:52928	SAND-90-7030
	Lawrence Livermore National Lab., CA (USA)	
	15:54436	UCRL-JC-104360
	15:52751	CONF-8904193-
	15:53334	Published article
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AC04-76DR00789	Sandia National Labs., Livermore, CA (USA)	
	15:53234	SAND-90-8204
	15:53425	SAND-90-8486
AC04-87AL43058	United Technologies Research Center, East Hartford, CT (USA)	
	15:53184	DOE/AL/43058-T4
AC04-88DP43495	Sandia National Labs., Albuquerque, NM (USA)	
	15:52906	SAND-90-2217C
	EG and G Mound Applied Technologies, Miamisburg, OH (USA)	
	15:53313	MLM-MU-90-69-0003

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AC05-76ER02504	**Maryland Univ., College Park, MD (USA). Dept. of Physics and Astronomy**	
	15:53990	DOE/ER/02504–516
AC05-84OR21400	**International Atomic Energy Agency, Vienna (Austria)**	
	15:54278	IAEA-CN–53/F-3-5
	Oak Ridge National Lab., TN (USA)	
	15:52641	ORNL/FMP–90/1
	15:52642	ORNL/TM–11039
	15:52643	ORNL/TM–11465
	15:52777	ORNL/TM–11466
	15:52807	ORNL/TM–11652
	15:52905	ORNL–6618
	15:52907	ORNL/TM–11615
	15:52913	CONF-900512–4
	15:52914	ORNL–6625
	15:52959	ORNL/FTR–3752
	15:52962	CONF-9010224–1
	15:52979	CONF-9010196–2-Vugraphs
	15:53013	ORNL/FTR–3687
	15:53017	ORNL/TM–11161
	15:53049	CONF-9010217–1
	15:53054	CONF-9009273–1
	15:53055	CONF-9009273–2
	15:53056	CONF-9010185–3
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	15:53081	ORNL/TM–11324
	15:53103	CONF-9008119–1
	15:53106	ORNL–6608/R6
	15:53107	ORNL–6608/R7
	15:53108	ORNL–6608/R8
	15:53109	ORNL/FTR–3784
	15:53129	ORNL/CON–306
	15:53130	ORNL/FTR–3778
	15:53131	ORNL/TM–11567
	15:53150	ORNL/M–1245
	15:53151	ORNL/M–1267
	15:53152	ORNL/TM–11339
	15:53153	ORNL/TM–11602
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	15:53161	ORNL/TM–11489
	15:53162	ORNL/TM–11596
	15:53175	ORNL/TM–11383
	15:53176	ORNL/TM–11406
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	15:53187	ORNL/M–1248
	15:53189	ORNL/TM–11622
	15:53195	ORNL/TM–11593
	15:53207	CONF-901004–8
	15:53208	CONF-901035–8
	15:53227	ORNL/M–983
	15:53257	CONF-9010193–1
	15:53263	ORNL/FTR–3783
	15:53265	ORNL/TM–11522
	15:53291	CONF-901125–2
	15:53292	CONF-9006174–2
	15:53314	ORNL–6603
	15:53355	CONF-9006277–1
	15:53362	ORNL/FTR–3773
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	15:53549	CONF-9010212–2
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	15:53552	CONF-9010212–7
	15:53553	CONF-9010220–1
	15:53566	ORNL/FTR–3797
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	15:53579	CONF-8906311–
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	15:53587	ORNL/TM–11503
	15:53591	ORNL–6637
	15:53592	ORNL/TM–11275
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	15:53654	ORNL/ER–16
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	15:53810	CONF-9008158–2
	15:53833	ORNL–6621
	15:53834	ORNL/TM–11618
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	15:53933	CONF-901116–14
	15:53934	CONF-901116–15
	15:53935	CONF-901116–17
	15:53946	ORNL/FTR–3774
	15:53947	ORNL/FTR–3786
	15:53980	ORNL/FTR–3699
	15:54192	CONF-900936–12
	15:54193	CONF-901116–6
	15:54194	CONF-901116–16
	15:54220	ORNL/FTR–3772
	15:54235	CONF-900990–1
	15:54267	CONF-901007–19
	15:54277	IAEA-CN–53/F-3-1
	15:54279	ORNL/FTR–3775
	15:54280	ORNL/TM–11521
	15:54348	CONF-901007–18
	15:54349	CONF-901035–7
	15:54351	DOE/ER–0313/8
	15:54368	ORNL–6086/V1
	15:54369	ORNL/FTR–3788
	15:54370	ORNL/TM–11562
	15:54416	CONF-901209–1
	15:54423	ORNL/TM–11130
	15:54424	ORNL/TM–11496
	15:54425	ORNL/TM–11634
	15:54426	ORNL/TM–11639
	15:54445	ORNL/TM–11287-Rev.1
	15:54446	ORNL/TM–11583
	15:54447	ORNL/TM–11595
	15:52806	ORNL/TM–11555
	15:52915	ORNL/Sub–88-SC006/1
	15:53185	ORNL/Sub–87-00184/02
	15:53264	ORNL/Sub–87-SB047C/1
	15:53410	ORNL/Sub–89-SD841/3
	15:53804	CONF-9007175–1
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	15:54195	CONF-8908202–2
	Pacific Northwest Lab., Richland, WA (USA)	
	15:54371	PNL-SA–18576
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	15:53653	ORNL/CDIAC–36
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	15:54311	CONF-8905120–
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	15:53968	Published article
	15:54171	Published article
	15:54392	Published article
AC05-84OS21400	**Oak Ridge Y-12 Plant, TN (USA)**	
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AC05-84OT21400	**Oak Ridge National Lab., TN (USA)**	
	15:52801	K/QT–382
	15:53385	K/CSD/TM–89
AC05-86OR21642	**Oak Ridge National Lab., TN (USA)**	
	15:52805	ORNL/TM–11554
AC06-76RL01830	**General Electric Co., Richland, WA (USA). Hanford Atomic Products Operation**	
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	Electric Power Research Inst., Palo Alto, CA (USA)	
	15:52778	EPRI-NP–6941
	Pacific Northwest Lab., Richland, WA (USA)	
	15:52779	ISPO–325
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	15:52955	PNL-SA–17712
	15:53132	PNL–7378
	15:53170	PNL-SA–17707
	15:53266	PNL-SA–18319
	15:53698	PNL–7471
	15:54371	PNL-SA–18576
	15:54372	PNL-SA–18584
	15:52809	PNL–7400
	15:53155	PNL–7299-Vol.2
	15:53156	PNL–7299-Vol.3
	15:52785	Published article
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AC06-84RL10436	**Pacific Northwest Lab., Richland, WA (USA)**	
	15:52809	PNL–7400
AC06-87RL10930	**Westinghouse Hanford Co., Richland, WA (USA)**	
	15:52782	WHC-SA–0934
	15:52783	WHC-SA–0935
	15:52815	WHC-EP–0188
	15:52816	WHC-EP–0342
	15:52817	WHC-EP–0342-Add.2
	15:52818	WHC-EP–0342-Add.3
	15:52819	WHC-EP–0342-Add.4
	15:52820	WHC-EP–0342-Add.5
	15:52821	WHC-EP–0342-Add.6
	15:52822	WHC-EP–0342-Add.7
	15:52823	WHC-EP–0342-Add.8
	15:52824	WHC-EP–0342-Add.9
	15:52825	WHC-EP–0342-Add.10
	15:52826	WHC-EP–0342-Add.11
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	15:52832	WHC-EP–0342-Add.17
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	15:52841	WHC-EP–0342-Add.31
	15:52842	WHC-EP–0342-Add.32
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	15:52846	WHC-SP–0464-Rev.1
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	15:53020	WHC-SA–0948
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	15:53700	WHC-EP–0372-Vol.1
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AC07-76ID01570	**Nuclear Regulatory Commission, Washington, DC (USA). Div. of Engineering**	
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	Golder Associates, Inc., Redmond, WA (USA)	
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	15:52761	CONF-8904193–
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AC07-84ID12435	**Westinghouse Idaho Nuclear Co., Inc., Idaho Falls, ID (USA)**	
	15:53414	WINCO–1080
AC07-84ID12536	**Babcock and Wilcox Co., Lynchburg, VA (USA). Research and Development Div.**	
	15:53165	DOE/ID/12536–2
AC08-88NV10617	**EG and G Energy Measurements, Inc., Pleasanton, CA (USA)**	
	15:53555	EGG–10617-4110
AC09-89SR18035	**Savannah River Lab., Aiken, SC (USA). Technical Div.**	
	15:53014	DPST–64-120
	Westinghouse Savannah River Co., Aiken, SC (USA)	
	15:52847	WSRC-RP–89-1442
	15:53093	WSRC-MS–90-94
	15:53426	WSRC-MS–90-158
	15:53701	WSRC-RP–89-313
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AC21-83MC20108	**Battelle Columbus Div., OH (USA)**	
	15:52956	CONF-850522–4
AC21-86MC22247	**General Electric Co., Schenectady, NY (USA). Research and Development Center**	
	15:52627	DOE/MC/22247–2859
AC21-87MC23284	**Brown Univ., Providence, RI (USA). Div. of Engineering**	
	15:52651	DOE/MC/23284–2871
AC21-88MC25042	**Baker/TSA, Inc., Coraopolis, PA (USA)**	
	15:52657	DOE/MC/25042–2872
AC22-81PC40267	**Combustion Engineering, Inc., Windsor, CT (USA). Power Systems Group**	
	15:52706	DOE/PC/40267–2
AC22-82PC50271	**Combustion Engineering, Inc., Windsor, CT (USA)**	
	15:52707	DOE/PC/50271–T3-Vol.1
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	15:52710	DOE/PC/50271–T3-Vol.4
	15:52711	DOE/PC/50271–T3-Vol.5
AC22-87PC90016	**North Dakota Univ., Grand Forks, ND (USA). Energy and Environmental Research Center**	
	15:52633	DOE/PC/90016–T8
AC22-88PC88865	**ETS, Inc., Roanoke, VA (USA)**	
	15:52957	DOE/PC/88865–T3
AC22-88PC88867	**Southern Research Inst., Birmingham, AL (USA)**	
	15:52958	DOE/PC/88867–T8

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AC22-88PC88881	ICF Kaiser Engineers, Inc., Pittsburgh, PA (USA)	
	15:52616	DOE/PC/88881–T7
AC22-89PC89866	Amoco Oil Co., Naperville, IL (USA). Research and Development Dept.	
	15:52632	DOE/PC/89866–T1
AC34-90DP62349	EG and G Rocky Flats, Inc., Golden, CO (USA)	
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	15:52898	RFP–4444
	15:53229	RFP–4432
	15:54397	RFP–4439
	EG and G Rocky Flats, Inc., Golden, CO (USA). Rocky Flats Plant	
	15:53037	RFP–4365
	15:53228	RFP–4253
AI01-76ET20320	National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center	
	15:53295	DOE/NASA/20320–76
AI08-78ET44802	Geological Survey, Denver, CO (USA)	
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00313	15:54234	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91605315	
00314	15:53816	NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS		DE91605741	
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CNIC-I– 004	15:54399	NTIS (US Sales Only), PC A07/MF A01; OSTI; INIS		DE91606195	
CONF-850522–		(5. annual contractors' review meeting on contaminant control in hot coal derived gas streams; Morgantown, WV (USA); 7-9 May 1985)			
4	15:52956	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91001507	MF-106
CONF-8610472–		(International symposium on the theory of elementary particles; Ahrenshoop (German Democratic Republic); 13-17 Oct 1986)			
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CONF-8705410–		(IAEA working group on high-speed reactors; Karlsruhe (Germany, F.R.); 5-8 May 1987)			
	15:53200	*See* BISI–26853			
CONF-870564–		(1987 socioeconomic energy research and analysis conference; Washington, DC (USA); 21-22 May 1987)			
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CONF-8801144–		(Short and ultrashort wavelength lasers meeting; Los Angeles, CA (USA); 14-15 Jan 1988)			
	15:53459	Soc. of Photo-Optical Instr. Engineers, 1022 19 St., P.O. Box 10, Bellingham, WA 98227 (USA)			
CONF-880201–		(Waste management '88: symposium on radioactive waste management; Tucson, AZ (USA); 28 Feb - 3 mar 1988)			
46	15:52780	*See* SAND–88-0506C			
CONF-8807172–		(10. Dundee conference on differential equations; 3. Society for Industrial and Applied Mathematics (SIAM) conference on domain decomposition methods; Dundee (UK); Houston, TX (USA); 4-8 Jul 1988; 20-22 mar 1989)			
2	15:54413	*See* BNL–45180			
CONF-8808122–		(8. international conference on positron annihilation; Gent (Belgium); 29 Aug - 3 sep 1988)			
	15:53204	*See* CEA-CONF–10122			
	15:53255	*See* CEA-CONF–10123			
	15:53290	*See* CEA-CONF–10121			
CONF-880853–		(3. international conference on applications of artificial intelligence in engineering; Stanford, CA (USA); 8-11 Aug 1988)			
2	15:53597	*See* UCRL–98069			
CONF-8809499–		(6. Latin American School on Theoretical Chemistry; Rio de Janeiro (Brazil); 11-17 Sep 1988)			
	15:53337	*See* CBPF-MO–001/89			
	15:53338	*See* CBPF-MO–001/89			
CONF-8812148–		(Technical committee on high conversion and high burnup reactors; Kumatori (Japan); 21-22 Dec 1988)			
	15:52970	*See* KURRI-TR–328			

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CONF-881268–		(14. Texas symposium on relativistic astrophysics; Dallas, TX (USA); 11-16 Dec 1988)			
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CONF-890009–		(3. DYNA3D user group conference; London (UK);			
	15:53404	*See* AEEW-M–2592			
CONF-890129–		(1989 coal-handling systems; Pensacola, FL (USA); 24-27 Jan 1989)			
	15:52692	*See* EPRI-GS–6996			
CONF-890186–		(Workshop on structural design criteria for HTR; Julich (Germany, F.R.); 31 Jan - 1 feb 1989)			
	15:52991	*See* Juel-Conf–71			
CONF-8902110–		(2. international symposium on the fourth family of quarks and leptons; Santa Monica, CA (USA); 23-25 Feb 1989)			
	15:53909				
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	15:54080				
CONF-890247–		(5. European symposium on semiconductor detectors: new developments on radiation detectors; Munich (Germany, F.R.); 21-23 Feb 1989)			
4	15:53577	*See* BNL–44865			
CONF-8903169–		(10. Dundee conference on differential equations; 3. Society for Industrial and Applied Mathematics (SIAM) conference on domain decomposition methods; Dundee (UK); Houston, TX (USA); 4-8 Jul 1988; 20-22 mar 1989)			
4	15:54413	*See* BNL–45180			
CONF-8903175–		(24. Recontre de Moriond conference; Les Arcs (France); 12-17 Mar 1989)			
	15:54014	*See* CEA-CONF–10023			
CONF-890415–		(International conference on computing in high energy physics; Oxford (UK); 10-14 Apr 1989)			
14	15:53527	*See* SLAC-PUB–5293			
CONF-8904193–		(22. annual oil shale symposium; Golden, CO (USA); 19-20 Apr 1989)			
	15:52751				
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CONF-8905120–		(8. topical conference on radio frequency power in plasmas; Irvine, CA (USA); 1-3 May 1989)			
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	15:54320				
	15:54321				

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
	15:54322				
	15:54323				
CONF-8905232--		(4. workshop on perspectives in nuclear physics at intermediate energies; Trieste (Italy); 8-12 May 1989)			
	15:54081	*See* CEA-CONF--10071			
CONF-8906195--		(IAEA IWG-NPPCI specialists' meeting on early failure detection and diagnosis in nuclear power plants' systems and operational experience; Dresden (German Democratic Republic); 20-22 Jun 1989)			
	15:52978	*See* CEA-CONF--10048			
CONF-8906239--		(1989 complex systems summer school; Santa Fe, NM (USA); 5-30 Jun 1989)			
Vol.2	15:54419	*See* DOE/ER/25075--1			
CONF-8906311--		(ORNL/BNL workshop on neutron scattering instrumentation at high flux reactors; Oak Ridge, TN (USA); 5-7 Jun 1989)			
	15:53579	NTIS, PC A04/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91001003	MF-400
CONF-8906368--		(CERN-JINR school of physics; Geneva (Switzerland); 25 Jun - 8 jul 1989)			
1	15:53978	*See* FNAL/C--90/164-T			
CONF-890668--		(Symposium on low-grade fuels; Helsinki (Finland); 12-16 Jun 1989)			
Vol.1	15:52615	*See* VTT-SYMP--107			
CONF-8907150--		(12. course of the International School of Nuclear Physics: the nature of hadrons and nuclei studied by electron scattering; Erice (Italy); 16-25 Jul 1989)			
	15:53987	*See* CEA-CONF--10130			
CONF-8907154--		(Enrico Fermi summer course CX11: nuclear collisions from the mean field into the fragmentation regime; Varenna (Italy); 11-21 Jul 1989)			
	15:53941	*See* GANIL-P--8917			
CONF-8907223--		(Final research co-ordination meeting on radiation damage to organic materials in nuclear reactors and radiation environments; Takasaki (Japan); 17-20 Jul 1989)			
	15:53389	*See* IAEA-TECDOC--651			
CONF-8908129--		(12. workshop on nuclear physics; Iguazu Falls (Argentina); 28 Aug - 1 sep 1989)			
	15:54132	*See* CEA-CONF--10051			
CONF-8908165--		(5. international conference on PIXE and its analytical applications; Amsterdam (Netherlands); 20-26 Aug 1989)			
	15:53346	*See* CEA-CONF--10128			
CONF-8908196--		(Conference on hadrons and hadronic matter; Cargese (France); 7-18 Aug 1989)			
	15:54131	*See* CEA-CONF--10050			
CONF-8908202--		(6. international swarm seminar; Glen Cove, NY (USA); 3-5 Aug 1989)			
2	15:54195	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91001270	MF-410
CONF-890827--		(7. international symposium on offshore engineering (Brasil offshore '89); Rio de Janeiro (Brazil); 21-25 Aug 1989)			
1	15:53437	*See* GKSS--89/E/62			
CONF-890903--		(International Europhysics conference on high-energy physics; Madrid (Spain); 6-14 Sep 1989)			
	15:54027	*See* LU-TP--89-17			
CONF-8909108--		(Seminar on the nuclear fuel cycle; Gif-sur-Yvette (France); 18 Sep - 6 oct 1989)			
	15:52768	*See* CEA-CONF--10076			
CONF-8909143--		(1989 EPRI heat-rate improvement conference; Knoxville, TN (USA); 26-28 Sep 1989)			
	15:52952	*See* EPRI-GS--6985			
CONF-8909178--		(US-Korea joint seminar on fluids engineering and science; Seoul (Republic of Korea); 3-9 Sep 1989)			
2	15:53975	*See* BNL--45182			

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CONF-8909225–		(Actinides '89; Tashkent (USSR); 24-29 Sep 1989)			
	15:52771	*See* CEA-CONF–10061			
CONF-8909267–		(7. international conference on liquid and amorphous metals; Kyoto (Japan); 4-8 Sep 1989)			
	15:53203	*See* CEA-CONF–10079			
CONF-8909370–		(Workshop on DYNA3D; Trondheim (Norway); 7 Sep 1989)			
	15:53026	*See* AEEW-M–2591			
CONF-8909372–		(European Conference on Accelerator Applications in Research; Francfort, DE (USA); 5-9 Sep 1989)			
	15:53347	*See* CEA-CONF–10133			
CONF-890982–		(Specialists' meeting on neutron activation cross sections for fission and fusion energy applications; Argonne, IL (USA); 13-15 Sep 1989)			
	15:54077	*See* NEANDC–259-U			
CONF-891013–		(6. symposium on separation science and technology for energy applications; Knoxville, TN (USA); 22-27 Oct 1989)			
	15:52772	*See* CEA-CONF–10066			
	15:52797	*See* CEA-CONF–10067			
CONF-8910237–		(International school seminar on heavy ion physics; Dubna (USSR); 3-12 Oct 1989)			
	15:53490	*See* GANIL-P–8918			
CONF-891029–		(ECASIA 89: European conference on applications of surface and interface analysis; Juan-les-Pins (France); 23-27 Oct 1989)			
	15:53344	*See* CEA-CONF–10073			
CONF-8910471–		(9. plenary meeting of the International Working Group on Water Reactor Fuel Performance and technology; Vienna (Austria); 2-4 Oct 1989)			
	15:52989	*See* IWGFPT–33			
CONF-891092–		(3. annual topical conference on high T_c superconducting thin films: processing, characterization, and applications; Boston, MA (USA); 23-27 Oct 1989)			
	15:53272				
	15:53273				
	15:53274				
	15:53276				
	15:54238				
CONF-8911150–		(6. international conference on recent progress in many body theories; Arad (Israel); 6-10 Nov 1989)			
	15:54015	*See* CEA-CONF–10080			
CONF-8911151–		(ICOER '89: 1st international conference on ocean energy recovery; Honolulu, HI (USA); 28-30 Nov 1989)			
3	15:52935	*See* SERI/TP–253-3594			
CONF-891117–		(34. conference on magnetism and magnetic materials; Boston, MA (USA); 28 Nov - 1 dec 1989)			
	15:53253	*See* CEA-CONF–10083			
CONF-8911216–		(Workshop on the contribution to the Nuclear Structure of Light Nuclei far from Stability Experiment and Theory Workshop; Overnai (France); 27-29 Nov 1989)			
	15:54097	*See* GANIL-P–9002			
CONF-8911243–		(Security training symposium: meeting the challenge – firearms and explosives recognition and detection; Bethesda, MD (USA); 28-30 Nov 1989)			
	15:54396	*See* NUREG/CP–0107			
CONF-8911246–		(PMDS 89: Protection, handling, detection and Safety meeting; Marseille (France); 7-9 Nov 1989)			
	15:53583	*See* CEA-DAS–678			

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CONF-8911247–		(26. European Cyclotron Progress Meeting; Louvain-la-Neuve (Belgium); 22-25 Nov 1989)			
	15:53516	*See* GANIL-A–8911			
CONF-8911248–		(4. Symposium on Lasers Aids Plasmas Diagnostics; Fukuoka (Japan); 20-23 Nov 1989)			
	15:54263	*See* CEA-CONF–10114			
CONF-891157–		(International conference on superconductivity; Paris (France); 23-24 Nov 1989)			
	15:53254	*See* CEA-CONF–10088			
CONF-891204–		(4. international conference on fusion reactor materials; Kyoto (Japan); 4-8 Dec 1989)			
	15:54345	*See* CEA-CONF–10081			
CONF-891274–		(1989 symposium on high temperature superconductivity; Los Alamos, NM (USA); 6-9 Dec 1989)			
	15:53262	*See* LA-UR–90-3269			
CONF-9001120–		(18. International Winter Meeting on Nuclear Physics; Bormio (Italy); 22-26 Jan 1990)			
	15:54082	*See* CENBG–9001			
	15:54109	*See* CEA-CONF–10209			
CONF-9001121–		(20. European Conference on Laser Interaction with Matter; Schliersee, DE (USA); 22-26 Jan 1990)			
	15:54346	*See* CEA-CONF–10210			
CONF-9001122–		(Nuclear Physics Winter School; Hirschegg (Austria); 15-20 Jan 1990)			
	15:54133	*See* CEA-CONF–10094			
CONF-900135–		(15. general meeting of the Division of Particles and Fields of the American Physical Society; Houston, TX (USA); 3-6 Jan 1990)			
	15:54023	*See* HD-PY–90/3			
CONF-900143–		(Institute for Electronic and Electrical Engineers (IEEE) nuclear science symposium; San Francisco, CA (USA); 15-19 Jan 1990)			
	15:53572				
	15:53702				
CONF-9002155–		(TRADE special interest group advanced training technologies meeting; Orlando, FL (USA); 16 Feb 1990)			
1	15:54438	*See* WHC-SA–0832			
CONF-900223–		(2. international conference on nuclear microprobe technology and applications; Melbourne (Australia); 5-9 Feb 1990)			
	15:53345	*See* CEA-CONF–10126			
CONF-900289–		(RCNP cyclotron cascade workshop on polarized ion sources and gas jets for nuclear physics at an intermediate energy; Tsukuba-Shi (Japan); 12-17 Feb 1990)			
	15:53526	*See* RCNP-T–28			
CONF-9003144–		(2. international workshop on fossil fuel fired MHD retrofit of existing power stations; Bologna (Italy); 21-23 Mar 1990)			
	15:53134	NTIS (US Sales Only), PC A12/MF A01		DE91712706	
CONF-9003161–		(25. Rencontres de Moriond on QCD and hadronic interactions conference; Les Arcs (France); 4-10 Mar 1990)			
10	15:53996	*See* FNAL/C–90-187-T			
11	15:54022	*See* FNAL/C–90/188-T			
CONF-9003218–		(6. PEF status colloquium of Kernforschungszentrum Karlsruhe; Karlsruhe (Germany, F.R.); 6-8 Mar 1990)			
	15:53846	*See* KFK-PEF–62			
Vol.1	15:53845	*See* KFK-PEF–61-Vol.1			
CONF-9003220–		(Course on power converters for particle accelerators; Montreux (Switzerland); 26-30 Mar 1990)			
	15:53503	*See* CERN–90-07			
CONF-9003221–		(PASCOS 90; Boston, MA (USA); Mar 1990)			
1	15:54042	*See* DOE/ER/40423–10-P90			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-9003224–		(Briefing for NAS Soviet delegation visit to Lawrence Livermore National Laboratory (LLNL); Livermore, CA (USA); 22 Mar 1990)			
1	15:53456	*See* UCRL-JC–103354			
CONF-900355–		(Chapman conference on global biomass burning: atmospheric, climatic, and biospheric implications; Williamsburg, VA (USA); 19-23 Mar 1990)			
1	15:53637	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91001212	MF-402
CONF-900406–		(1. international topical meeting on high-level radioactive waste management; Las Vegas, NV (USA); 8-12 Apr 1990)			
17	15:52812	*See* SAND–88-2845			
CONF-9004209–		(Workshop on the science of intense radioactive ion beams; Los Alamos, NM (USA); 10-12 Apr 1990)			
	15:53500	*See* LA–11964-C			
CONF-9004244–		(American Chemical Society (ACS) symposium on non-linear materials (NLO) conference; Boston, MA (USA); 23 Apr 1990)			
1	15:54381	*See* UCRL-JC–105000			
CONF-9004249–		(Industrial power distribution seminar; Cookeville, TN (USA); 24 Apr 1990)			
1	15:53093	*See* WSRC-MS–90-94			
CONF-900466–		(Spring meeting of the Materials Research Society; San Francisco, CA (USA); 16-21 Apr 1990)			
88	15:53266	*See* PNL-SA–18319			
CONF-900512–		(12. symposium on biotechnology fuels and chemicals; Gatlinburg, TN (USA); 7-11 May 1990)			
4	15:52913	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91001490	MF-246
CONF-9005233–		(2. international conference on medium- and high-energy physics; Taipei (Taiwan); 8-18 May 1990)			
6	15:53993	*See* FNAL/C–90/163E			
7	15:54154	*See* DOE/ER/40427–8-N90			
CONF-9005238–		(Symposium in honor of Akito Arima: nuclear physics in the 1990's; Santa Fe, NM (USA); 1-5 May 1990)			
3	15:53888	*See* DOE/ER/40427–13-N90			
CONF-9005245–		(International workshop on correlations and multiparticle production (CAMP); Marburg (Germany, F.R.); 14-16 May 1990)			
3	15:53994	*See* FNAL/C–90/166-E			
CONF-9005277–		(U.S. space foundation space launch forum; Colorado Springs, CO (USA); 23-25 May 1990)			
1	15:53163	*See* UCRL-JC–103946			
CONF-9005280–		(North American Benthological society conference; Blacksburg, VA (USA); 21-25 May 1990)			
1	15:53788	*See* WSRC-MS–90-70			
CONF-900546–		(4. conference on fossil energy materials; Oak Ridge, TN (USA); 15-17 May 1990)			
	15:52641	*See* ORNL/FMP–90/1			
CONF-900557–		(8. topical conference on high-temperature plasma diagnostics; Hyannis, MA (USA); 6-10 May 1990)			
14	15:54282	*See* UCRL-JC–103883			
17	15:54273	*See* GA-A–20108			
18	15:54272	*See* GA-A–20107			
19	15:54271	*See* GA-A–20104			
20	15:54274	*See* GA-A–20112			
21	15:54275	*See* GA-A–20113			
CONF-900570–		(8. international conference on ultrarelativistic nucleus-nucleus collisions: Quark Matter '90; Menton (France); 7-11 May 1990)			
13	15:54121	*See* BNL–45239			
14	15:53998	*See* FNAL/C–90/205-E			

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CONF-900601–		(12. PANIC international conference on particles and nuclei; Cambridge, MA (USA); 24-29 Jun 1990)			
14	15:54103	*See* BNL–45238			
15	15:53889	*See* DOE/ER/40427–18-N90			
CONF-900602–		(17. European conference on controlled fusion and plasma heating; Amsterdam (Netherlands); 25-29 Jun 1990)			
21	15:54276	*See* GA-A–20181			
CONF-9006105–		(28. symposium on engineering aspects of magnetohydrodynamics; Chicago, IL (USA); 26-28 Jun 1990)			
11	15:53160	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017827	
CONF-9006174–		(5. international conference on metalorganic vapor phase epitaxy; Aachen (Germany, F.R.); 18-21 Jun 1990)			
2	15:53292	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91000717	MF-404
CONF-9006212–		(International symposium on nuclear astrophysics: nuclei in the cosmos; Vienna (Austria); 18-22 Jun 1990)			
4	15:53890	*See* DOE/ER/40427–19-N90			
CONF-9006260–		(4. Canadian supercomputing symposium; Montreal (Canada); 4-6 Jun 1990)			
1	15:54424	*See* ORNL/TM–11496			
CONF-9006268–		(10. international conference on physics in collision; Durham, NC (USA); 21-23 Jun 1990)			
5	15:53995	*See* FNAL/C–90/173			
CONF-9006273–		(14. workshop on condensed matter theories; Elba (Italy); 18-23 Jun 1990)			
2	15:54218	*See* LA-UR–90-2950			
CONF-9006277–		(U.S. army chemical research development and engineering conference on aerosols and obscuration; Aberdeen, MD (USA); 25-27 Jun 1990)			
1	15:53355	NTIS, PC A01/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91000612	MF-401
CONF-9006282–		('90 nobel symposium: The birth and early evolution of our universe; Ostersund (Sweden); 11-16 Jun 1990)			
1	15:53887	*See* DOE/ER/40272–111			
CONF-900634–		(7. world ceramics congress: ceramics today–tomorrow's ceramics; Montecatini Terme (Italy); 24-30 Jun 1990)			
	15:53012	*See* Juel-Spez–565			
CONF-900646–		(31. US symposium on rock mechanics; Golden, CO (USA); 18-20 Jun 1990)			
1	15:52813	*See* SAND–89-2268			
CONF-900710–		(Balancing automation and human action in nuclear power plants; Munich (Germany, F.R.); 9-13 Jul 1990)			
1	15:53040	*See* JINR-E–10-90-323			
CONF-9007101–		(Los Alamos workshop on gamma-ray bursts; Taos, NM (USA); 29 Jul - 3 aug 1990)			
1	15:53907	*See* UCRL-JC–106057			
CONF-9007106–		(Institute of nuclear materials management conference; Los Angeles, CA (USA); 15-18 Jul 1990)			
76	15:54436	*See* UCRL-JC–104360			
CONF-9007131–		(3. international conference on the structure of surfaces; Milwaukee, WI (USA); 9-12 Jul 1990)			
3	15:54225	*See* UCRL-JC–104938			
CONF-9007136–		(1990 summer workshop on nonlinear and chaotic phenomena in plasmas, solids, and fluids; Edmonton (Canada); 16-27 Jul 1990)			
5	15:53948	*See* UCRL-JC–104150			
CONF-9007173–		(Dalitz conference; Oxford (UK); 5 Jul 1990)			
1	15:53979	*See* LBL–29405			
CONF-9007175–		(Genetic algorithms theory workshop; Bloomington, IN (USA); 16-18 Jul 1990)			
1	15:53804	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91000723	MF-401

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CONF-9007180–		(1990 international workshop on strong coupling gauge theories and beyond; Nagoya (Japan); 28-31 Jul 1990)			
1	15:54041	*See* DOE/ER/40423–09-P90			
CONF-9007181–		(5. symmetries in science: algebraic structures, their representations, realizations and physical applications; Voralberg (Austria); 30 Jul - 3 aug 1990)			
1	15:54034	NTIS, PC A04/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91001515	MF-414
CONF-900726–		(International conference on polarization phenomena in nuclear physics; Paris (France); 9-13 Jul 1990)			
3	15:53982	*See* BNL–45115			
4	15:54073	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91001295	MF-413
CONF-900731–		(NATO Advanced Study Institute on diamond and diamond-like films and coatings; Castelvecchio Pascoli (Italy); 22 Jul - 2 aug 1990)			
3	15:53312	*See* LA-UR–90-3317			
CONF-900756–		(SPIE's international symposium on optical and optoelectronic applied science and engineering exhibit; San Diego, CA (USA); 8-13 Jul 1990)			
46	15:54360	*See* LBL–29370			
51	15:53578	*See* BNL–45153			
CONF-900762–		(12. international CODATA conference: data for discovery; Columbus, OH (USA); 17-19 Jul 1990)			
1	15:53634	*See* BNL–44375			
CONF-900766–		(1. biennial conference on low energy antiproton physics; Stockholm (Sweden); 2-6 Jul 1990)			
4	15:53992	*See* DOE/ER/40427–25-N90			
CONF-900772–		(4. workshop on experiments and detectors for a relativistic heavy ion collider; Upton, NY (USA); 2-7 Jul 1990)			
6	15:53983	*See* BNL–45162			
7	15:53985	*See* BNL–45245			
8	15:53984	*See* BNL–45186			
CONF-900777–		(Workshop on science at the KAON factory; Vancouver (Canada); 23-28 Jul 1990)			
2	15:54129	*See* BNL–45144			
CONF-900791–		(Review of progress in quantitative NDE; La Jolla, CA (USA); 15-20 Jul 1990)			
3	15:53224	*See* LA-UR–90-2980			
CONF-900801–		(25. intersociety energy conversion engineering conference; Reno, NV (USA); 12-17 Aug 1990)			
34	15:53159	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91000720	MF-920
35	15:52955	*See* PNL-SA–17712			
36	15:53170	*See* PNL-SA–17707			
CONF-9008119–		(12. annual DOE low level waste management conference; Chicago, IL (USA); 28-29 Aug 1990)			
1	15:53103	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91000619	MF-400
2	15:52794	*See* BNL–45163			
CONF-9008129–		(11. biennial conference on chemical education; Atlanta, GA (USA); 5-9 Aug 1990)			
	15:53398	NTIS, PC A07/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91000889	MF-401
CONF-9008139–		(5. international symposium on solar high-temperature technologies; Davos (Switzerland); 27-31 Aug 1990)			
2	15:52937	*See* SAND–90-0903C			
CONF-9008142–		(Laser applications in life science; Moscow (USSR); 17-31 Aug 1990)			
2	15:53835	*See* UCRL-JC–104817			
CONF-9008145–		(1990 Nuclear Information Records Management Association symposium; Dallas, TX (USA); 25 Aug 1990)			
2	15:54449	*See* SAND–90-2389C			
3	15:54448	*See* SAND–90-2388C			

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CONF-9008158--		(2. international conference on the preservation of boar semen; Beltsville, MD (USA); 19-22 Aug 1990)			
1	15:53803	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91000617	MF-408
2	15:53810	NTIS, PC A01/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91000728	MF-408
CONF-9008160--		(200. ACS symposium on the establishment of research support agencies; Washington, DC (USA); 30 Aug 1990)			
1	15:53118	*See* LBL--29446			
CONF-900822--		(25. IUPAP international conference on high energy physics; Singapore (Singapore); 2-8 Aug 1990)			
11	15:53997	*See* FNAL/C--90/196-T			
CONF-900877--		(12. international congress for electron microscopy; Seattle, WA (USA); 12-18 Aug 1990)			
9	15:54222	*See* SAND--90-2549C			
CONF-9009107--		(Windpower '90; Washington, DC (USA); 25-28 Sep 1990)			
1	15:52944	*See* SAND--90-1148C			
2	15:52945	*See* SAND--90-1149C			
3	15:52946	*See* SAND--90-2538C			
4	15:52947	*See* SERI/TP--257-3983			
CONF-9009123--		(Linear accelerator conference; Albuquerque, NM (USA); 9-14 Sep 1990)			
36	15:53530	*See* SLAC-PUB--5322			
37	15:53529	*See* SLAC-PUB--5321			
38	15:53501	*See* BNL--45170			
39	15:53499	*See* FNAL/C--90/174			
40	15:53532	*See* UCRL-JC--103798			
CONF-900914--		(Vibrations at surfaces; Shelter Island, NY (USA); 10-14 Sep 1990)			
2	15:53340	*See* BNL--45184			
CONF-9009166--		(12. international free electron laser conference (FEL-12); Paris (France); 17-21 Sep 1990)			
7	15:53446	*See* BNL--45161			
8	15:53493	*See* BNL--45152			
CONF-900917--		(American Nuclear Society topical meeting on safety of non-commercial nuclear reactor research and irradiation facilities; Boise, ID (USA); 30 Sep - 3 oct 1990)			
18	15:53083	*See* UCRL--102683			
CONF-9009170--		(10. international seminar on high energy physics problems, relativistic nuclear physics and quantum chromodynamics; Dubna (USSR); 24-29 Sep 1990)			
1	15:54013	*See* BNL--45237			
CONF-9009174--		(5. international symposium on resonance ionization spectroscopy and its applications; Varese (Italy); 16-21 Sep 1990)			
6	15:53869	*See* LA-UR--90-3157			
CONF-900918--		(16. symposium on fusion technology; London (UK); 3-7 Sep 1990)			
10	15:54356	*See* GA-A--20238			
11	15:54357	*See* GA-A--20239			
12	15:54355	*See* GA-A--20231			
13	15:54354	*See* GA-A--20219			
14	15:54358	*See* GA-A--20250			
CONF-9009192--		(International symposium on discharges and electrical insulation in vacuum; Santa Fe, NM (USA); 17-20 Sep 1990)			
14	15:53531	*See* SLAC-PUB--5325			
15	15:53528	*See* SLAC-PUB--5320			
CONF-9009201--		(Radioluminescent technology conference; Annapolis, MD (USA); 25-26 Sep 1990)			
5	15:52906	*See* SAND--90-2217C			
CONF-9009221--		(6. international symposium on gaseous dielectrics; Knoxville, TN (USA); 23-27 Sep 1990)			
4	15:53865	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91000727	MF-408

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-9009228–		(Tough user's workshop; Berkeley, CA (USA); 13-14 Sep 1990)			
2	15:52814	*See* UCRL-JC–104756			
CONF-900923–		(5. international conference on the physics of highly charged ions; Giessen (Germany, F.R.); 10-14 Sep 1990)			
1	15:53951	*See* UCRL-JC–106069			
2	15:53950	*See* UCRL-JC–104992			
3	15:53949	*See* UCRL-JC–104991			
CONF-9009231–		(MARC finite element analysis users conference; Monterey, CA (USA); 20-21 Sep 1990)			
2	15:53229	*See* RFP–4432			
CONF-9009260–		(International symposium on coherent Raman spectroscopy; Samarkand (USSR); 18-20 Sep 1990)			
1	15:54219	*See* LA-UR–90-2982			
CONF-9009263–		(5. working meeting on radioactive interactions; Leipzig (Germany, F.R.); 24-28 Sep 1990)			
1	15:53926	*See* BNL–45214			
CONF-9009264–		(Conference on the effect of irradiation on materials of fusion reactors; Leningrad (USSR); 18-20 Sep 1990)			
2	15:54371	*See* PNL-SA–18576			
CONF-9009273–		(U.S./Japanese specialized topic workshop on pressurized thermal shock; Rockville, MD (USA); 26-28 Sep 1990)			
1	15:53054	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91000733	
2	15:53055	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91000734	
CONF-9009274–		(OE/Fibers '90; San Jose, CA (USA); 16-21 Sep 1990)			
1	15:53576	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91001221	
CONF-9009275–		(Workshop on soft lepton pair and photon production; Pittsburg, PA (USA); 6-8 Sep 1990)			
1	15:53986	*See* BNL–45246			
CONF-9009276–		(2. international workshop on accelerator alignment; Hamburg (Germany, F.R.); 10-12 Sep 1990)			
1	15:53492	*See* SLAC-PUB–5329			
CONF-900936–		(7. international conference on ion beam modification of materials; Knoxville, TN (USA); 9-14 Sep 1990)			
11	15:54221	*See* SAND–90-2440C			
12	15:54192	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91001276	MF-404
13	15:53315	*See* SAND–90-1125C			
14	15:53267	*See* SAND–90-1094C			
15	15:53231	*See* SAND–90-1068C			
CONF-900944–		(Applied superconductivity conference; Aspen, CO (USA); 24-28 Sep 1990)			
1	15:53454	*See* SAND–90-2244C			
4	15:53450	*See* LA-UR–90-3233			
13	15:54379	*See* UCRL-JC–103491			
CONF-900977–		(Spectrum '90: American Nuclear Society (ANS) international meeting on radioactive waste technologies, decontamination, and hazardous wastes; Knoxville, TN (USA); 30 Sep - 4 oct 1990)			
4-Draft	15:52811	*See* RFP–4396			
CONF-900990–		(4. annual conference on superconductivity and applications; Buffalo, NY (USA); 18-20 Sep 1990)			
1	15:54235	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91001518	MF-406
CONF-901004–		(Conference on magnetism and magnetic materials; San Diego, CA (USA); 30 Oct - 2 nov 1990)			
7	15:53201	*See* BNL–45147			
8	15:53207	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91001273	MF-404
CONF-901007–		(9. topical meeting on technology of fusion energy; Oak Brook, IL (USA); 7-11 Oct 1990)			
13	15:54376	*See* UCRL-CR–103819			
15	15:54383	*See* WHC-SA–0916			
16	15:54374	*See* SAND–90-2503C			

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17-Draft	15:54375	*See* SAND–90-2579C-Draft			
18	15:54348	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91001487	MF-420
19	15:54267	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91001488	MF-420
CONF-9010148–		(16. international symposium and exposition for testing and failure analysis; Los Angeles, CA (USA); 26 Oct - 7 nov 1990)			
1	15:53452	*See* SAND–90-1169C			
CONF-9010185–		(18. water reactor safety information meeting; Gaithersburg, MD (USA); 22-24 Oct 1990)			
3	15:53056	NTIS, PC A04/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91001632	
4	15:53057	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91001629	
CONF-9010193–		(Annual automotive technology development contractor coordination meeting; Dearborn, MI (USA); 22-25 Oct 1990)			
1	15:53257	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91000102	MF-336
CONF-9010196–		(U.S.-Japan specialized topic workshop (STW) on pressurized thermal shock; Rockville, MD (USA); 26-28 Oct 1990)			
2-Vugraphs	15:52979	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91000396	
CONF-9010205–		(1990 SAE international fuels and lubricants conference and exposition; Tulsa, OK (USA); 22-25 Oct 1990)			
1	15:53183	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91000729	MF-336
CONF-9010206–		(14. annual TRADE conference; Denver, CO (USA); 22-24 Oct 1990)			
1	15:54397	*See* RFP–4439			
2-Draft	15:52898	*See* RFP–4444			
CONF-9010209–		(Workshop on physics of alternative magnetic confinement schemes; Varenna (Italy); 14-15 Oct 1990)			
2	15:54382	*See* UCRL-JC–105056			
CONF-9010210–		(17. annual Ottawa verification symposium; Ottawa (Canada); 3-6 Oct 1990)			
1	15:53193	*See* BNL–45218			
CONF-9010212–		(Symposium on detector research and development for the superconducting super collider; Fort Worth, TX (USA); 15-18 Oct 1990)			
1	15:53544	*See* BNL–45262			
2	15:53549	NTIS, PC A01/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91001519	MF-414
3	15:53513	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91001486	MF-414
4	15:53555	*See* EGG–10617-4110			
5	15:53550	NTIS, PC A01/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91001522	MF-406; MF-414
6	15:53551	NTIS, PC A01/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91001619	MF-414
7	15:53552	NTIS, PC A01/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91001633	MF-414
CONF-9010217–		(16. MPA seminar; Stuttgart (Germany, F.R.); 4-5 Oct 1990)			
1	15:53049	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91001272	
CONF-9010220–		(1990 IEEE nuclear science symposium; Arlington, VA (USA); 23-27 Oct 1990)			
1	15:53553	NTIS, PC A01/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91001634	
CONF-9010223–		(13. AIAA aeroacoustics conference; Tallahassee, FL (USA); 22-24 Oct 1990)			
1	15:53976	*See* SAND–90-0179C			
CONF-9010224–		(International workshop on BWR stability; Upton, NY (USA); 18 Oct 1990)			
1	15:52962	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91001517	MF-523
CONF-901025–		(13. international conference on plasma physics and controlled nuclear fusion research; Washington, DC (USA); 1-6 Oct 1990)			
11	15:54373	*See* SAND–90-0968C			
12	15:54277	*See* IAEA-CN–53/F-3-1			
13	15:54278	*See* IAEA-CN–53/F-3-5			
CONF-901029–		(6. international cryocooler conference; Plymouth, MA (USA); 25-26 Oct 1990)			
1	15:53407	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91001520	MF-350
CONF-901035–		(37. national American Vacuum Society symposium; Toronto (Canada); 8-12 Oct 1990)			
5	15:54223	*See* SAND–90-2551C			
6	15:53233	*See* SAND–90-1362C			
7	15:54349	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91001255	MF-420

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8	15:53208	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91001277	MF-404
9	15:54281	*See* SAND–90-1387C			
10	15:53232	*See* SAND–90-1239C			
CONF-901073–		(178. meeting of the Electrochemical Society; Seattle, WA (USA); 14-19 Oct 1990)			
8	15:53453	*See* SAND–90-1770C			
CONF-901092–		(Carnahan conference on security technology; Lexington, KY (USA); 10 Oct 1990)			
4	15:53411	*See* SAND–89-1493C			
CONF-901101–		(American Nuclear Society winter meeting; Washington, DC (USA); 11-15 Nov 1990)			
36	15:53041	*See* WHC-SA–0976			
37	15:53082	*See* SAND–90-1525C			
38	15:53020	*See* WHC-SA–0948			
39	15:52782	*See* WHC-SA–0934			
40	15:52783	*See* WHC-SA–0935			
41	15:53019	*See* WHC-SA–0924			
CONF-901102–		(Annual meeting of the Optical Society of America, Inc.; Boston, MA (USA); 4-9 Nov 1990)			
1	15:53574	*See* SAND–90-0736C			
CONF-901105–		(Fall meeting of the Materials Research Society; Boston, MA (USA); 24 Nov - 1 dec 1990)			
17	15:53318	*See* SAND–90-2355C			
CONF-9011114–		(1990 international symposium on information theory and its applications; Honolulu, HI (USA); 27-30 Nov 1990)			
1	15:54450	*See* SAND–90-2589C			
CONF-9011120–		(11. annual symposium on New Mexico minerals; Socorro, NM (USA); 10-11 Nov 1990)			
1	15:53870	*See* SAND–90-2596C			
CONF-901116–		(11. international conference on the application of accelerators in research and industry; Denton, TX (USA); 5-8 Nov 1990)			
6	15:54193	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91000615	MF-414
12	15:54123	*See* UCRL-JC–106177			
13	15:53932	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91001217	MF-410
14	15:53933	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91001211	MF-414
15	15:53934	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91001214	MF-411
16	15:54194	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91001524	MF-404
17	15:53935	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91001628	MF-414
22	15:53588	*See* UCRL-JC–104433			
CONF-901125–		(2. international ceramic science and technology congress symposium on glasses for electronic applications; Orlando, FL (USA); 12-15 Nov 1990)			
2	15:53291	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91000392	MF-404
3	15:53316	*See* SAND–90-1675C			
CONF-901194–		(ASME winter annual meeting; Dallas, TX (USA); 25-30 Nov 1990)			
4	15:53426	*See* WSRC-MS–90-158			
CONF-901209–		(29. IEEE conference on decision and control; Honolulu, HI (USA); 5-7 Dec 1990)			
1	15:54416	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90008490	MF-405
2	15:53789	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90016530	MF-400
3	15:54428	*See* SAND–90-2387C			
4	15:54256	*See* LA-UR–90-3328			
5	15:54437	*See* UCRL-JC–104926			
6	15:54414	*See* BNL–45230			
CONF-901213–		(CASE '90: 4th international workshop on computer-aided software engineering; Irvine, CA (USA); 5-8 Dec 1990)			
1	15:54433	*See* UCRL-JC–103754			
CONF-901221–		(2. IEEE symposium on parallel and distributed processing; Dallas, TX (USA); 9-13 Dec 1990)			
1	15:54434	*See* UCRL-JC–103980			
CONF-901224–		(San Diego workshop on volume visualization; San Diego, CA (USA); 10-11 Dec 1990)			
1	15:54435	*See* UCRL-JC–104151			

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CONF-901229–		(7. optical fibre sensors conference; Sydney (Australia); 4-7 Dec 1990)			
1	15:53581	*See* SAND–90-2148C			
2	15:53580	*See* LA-UR–90-2900			
CONF-901235–		(21. IEEE semiconductor interface specialists conference; San Diego, CA (USA); 6-8 Dec 1990)			
1	15:53575	*See* SAND–90-2294C			
2	15:53455	*See* SAND–90-2291C			
CONF-901244–		(1990 international electron device conference; San Francisco, CA (USA); 10-12 Dec 1990)			
1	15:53317	*See* SAND–90-1911C			
2	15:53457	*See* UCRL-JC–104830			
CONF-901245–		(15. international conference on infrared and millimeter waves; Orlando, FL (USA); 10-14 Dec 1990)			
1	15:54380	*See* UCRL-JC–104815			
CONF-901246–		(EPRI workshop on applications of chaos; San Francisco, CA (USA); Dec 1990)			
1	15:53405	*See* BNL–45179			
2	15:54067	*See* BNL–45178			
CPDG–					
88-P-112	15:52786	*See* AEEW-R–2398			
CRIE-T–					
89020	15:53094	NTIS (US Sales Only), PC A03/MF A01		DE91715330	
89025	15:52670	NTIS (US Sales Only), PC A04/MF A01		DE91715328	
89028	15:53638	NTIS (US Sales Only), PC A06/MF A01		DE91715327	
89071	15:53090	NTIS (US Sales Only), PC A03/MF A01		DE91715329	
CRIE-Y–					
90004	15:53172	NTIS (US Sales Only), PC A04/MF A01		DE91715331	
CRIEPI-EW–					
89001	15:52622	Central Research Institute of Electric Power Industry, Tokyo (Japan)			
89002	15:52623	Central Research Institute of Electric Power Industry, Tokyo (Japan)			
89003	15:52695	Central Research Institute of Electric Power Industry, Tokyo (Japan)			
89004	15:52696	Central Research Institute of Electric Power Industry, Tokyo (Japan)			
89006	15:52697	Central Research Institute of Electric Power Industry, Tokyo (Japan)			
89007	15:52624	Central Research Institute of Electric Power Industry, Tokyo (Japan)			
89008	15:52698	Central Research Institute of Electric Power Industry, Tokyo (Japan)			
89009	15:52699	Central Research Institute of Electric Power Industry, Tokyo (Japan)			
89010	15:52700	Central Research Institute of Electric Power Industry, Tokyo (Japan)			
89011	15:52701	Central Research Institute of Electric Power Industry, Tokyo (Japan)			
89012	15:52702	Central Research Institute of Electric Power Industry, Tokyo (Japan)			
CRIEPI-W–					
89007	15:52625	Central Research Institute of Electric Power Industry, Tokyo (Japan)			
89009	15:52626	Central Research Institute of Electric Power Industry, Tokyo (Japan)			
89010	15:52703	Central Research Institute of Electric Power Industry, Tokyo (Japan)			
CRN-PN–					
8920	15:53514	NTIS (US Sales Only), PC A08/MF A01		DE91716290	
CTA-IEAv-RP–					
013/86	15:53936	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91605006	
015/86	15:54164	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91605386	
019/86	15:54268	NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS		DE91605136	
031/88	15:53937	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91605007	

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032/88	15:53938	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91605008	
033/88	15:54151	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91605469	
035/88	15:54165	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91605387	
06/87	15:54038	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91604929	
CWP–					
099	15:54417	*See* DOE/ER/14079–4			
DCN–					
90-218-043-66	15:53667	*See* PB–90-260514/XAB			
DESY–					
90-088	15:53988	NTIS (US Sales Only), PC A03/MF A01		DE91717062	
90-089	15:53989	NTIS (US Sales Only), PC A03/MF A01		DE91717064	
90-090	15:54021	NTIS (US Sales Only), PC A03/MF A01		DE91717063	
90-092	15:54039	NTIS (US Sales Only), PC A03/MF A01		DE91717061	
DLR-FB–					
90-25	15:53639	NTIS (US Sales Only), PC A06/MF A01		DE91717018	
DOE-RW–					
90.002	15:52787	*See* AERE-R–13312			
DOE/AL/43058–					
T4	15:53184	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017871	MF-361
DOE/BC–					
90/1	15:52732	NTIS, PC A07/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90000231	PC-122
DOE/BP–					
1305	15:53105	*See* DOE/EIS–0131-Vol.3			
1423	15:53124	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91000194	MF-900
DOE/BP/35738–					
2	15:53142	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91000205	MF-920
DOE/BP/64352–					
1	15:53143	NTIS, PC A06/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91000806	MF-350
DOE/BP/66141–					
3	15:53125	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91000804	MF-900
DOE/BP/95951–					
1	15:53144	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91000157	MF-350
2	15:53145	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91000158	MF-350
3	15:53146	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91000159	MF-350
DOE/CE/15401–					
T9	15:53584	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91001136	MF-310
DOE/CE/26593–					
1	15:53173	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015516	MF-350
DOE/CH/10239–					
1	15:53164	NTIS, PC A18/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90010576	MF-310
DOE/DP/40200–					
132	15:54350	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91001254	MF-712
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0315	15:52799	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91000842	MF-721
0642	15:53705	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91000834	MF-702
DOE/EH–					
0145-Vol.1	15:52895	NTIS, PC A17/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91000472	MF-630
0145-Vol.2	15:52896	NTIS, PC A21/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91000493	MF-630
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03P	15:53604	NTIS, PC A15/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91001092	MF-630
04P	15:53605	NTIS, PC A12/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91002504	MF-630
05P	15:53606	NTIS, PC A21/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91001067	MF-630
06P	15:53607	NTIS, PC A13/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91001073	MF-630
07P	15:53608	NTIS, PC A99/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91002512	MF-630
09P	15:53609	NTIS, PC A15/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91001074	MF-630
12P	15:53610	NTIS, PC A25/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91002506	MF-630
13P	15:53611	NTIS, PC A16/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91001062	MF-630
14P	15:53612	NTIS, PC A14/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91002503	MF-630
15P	15:53613	NTIS, PC A21/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91002499	MF-630
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17P	15:53615	NTIS, PC A15/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91001063	MF-630
19P	15:53616	NTIS, PC A10/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91001064	MF-630
20P	15:53617	NTIS, PC A16/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91002501	MF-630
21P	15:53618	NTIS, PC A14/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91001091	MF-630
22P	15:53619	NTIS, PC A99/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91001071	MF-630
23P	15:53620	NTIS, PC A14/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91002500	MF-630
24P	15:53621	NTIS, PC A09/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91002510	MF-630

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25P	15:53622	NTIS, PC A13/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91001088	MF-630
26P	15:53623	NTIS, PC A18/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91002505	MF-630
27P	15:53624	NTIS, PC A09/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91001065	MF-630
28P	15:53625	NTIS, PC A11/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91001072	MF-630
31P	15:53626	NTIS, PC A19/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91001075	MF-630
33P	15:53627	NTIS, PC A10/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91001090	MF-630
34P	15:53628	NTIS, PC A23/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91001093	MF-630
35P	15:53629	NTIS, PC A09/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91001068	MF-630
38P	15:53630	NTIS, PC A13/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91001061	MF-630
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89-87(TR)	15:52676	CANMET, Technical Information Services, 562 Booth St., Room 20C, Ottawa, ON, Canada K1A 0G1			
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12076-DE	15:52617	Commission of the European Communities, Luxembourg			
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12405	15:52966	NTIS (US Sales Only), PC A17/MF A01			
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12434	15:52986	NTIS (US Sales Only), PC A03/MF A01			
12435	15:53432	NTIS (US Sales Only), PC A03/MF A01			
12472-EN	15:52714	Commission of the European Communities, Luxembourg			
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12590-EN	15:52637	Commission of the European Communities, Luxembourg			
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12653-IT	15:52618	Commission of the European Communities, Luxembourg			
12654-DE	15:52679	Commission of the European Communities, Luxembourg			
12655-EN	15:52680	Commission of the European Communities, Luxembourg			
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13-2-6	15:53848	*See* PB–90-245093/XAB			
FNAL/C–					
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9002	15:54097	NTIS (US Sales Only), PC A02/MF A01		DE91716318	
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1241	15:53705	*See* DOE/EA–0642			
GKSS–					
89/E/56	15:53436	Special print from Robotersysteme (1989) v. 5 p. 233-237			
89/E/62	15:53437	NTIS (US Sales Only), PC A03/MF A01		DE91712415	
90/E/15	15:53357	Special print from J. Radioanal. Nucl. Chem. (1990) v. 139(1) p. 43-53			
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4697	15:53439	*See* AD-A–223979/6/XAB			
GL-TR–					
90-0147	15:53879	*See* AD-A–223987/9/XAB			
90-0148	15:53878	*See* AD-A–223986/1/XAB			
90-0149	15:53877	*See* AD-A–223985/3/XAB			
90-0150	15:53884	*See* AD-A–223997/8/XAB			
90-0151	15:53883	*See* AD-A–223996/0/XAB			
90-0152	15:53882	*See* AD-A–223995/2/XAB			
90-0155	15:53881	*See* AD-A–223994/5/XAB			
90-0157	15:53880	*See* AD-A–223993/7/XAB			
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66995	15:53051	NTIS, PC A01/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91001399	MF-706
79303	15:53642	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91001400	MF-706
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9003/02	15:53643	Available from Industrieanlagen-Betriebsgesellschaft mbH (IABG), Ottobrunn (Germany, F.R.). Hauptabteilung Datenverarbeitung und Informatik			
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0057	15:53496	*See* CNIC–00245			
0059	15:54134	*See* CNIC–00247			
0060	15:53205	*See* CNIC–00248			
0063	15:52774	*See* CNIC–00251			
0064	15:52775	*See* CNIC–00252			
IAEA-CN–					
53/F-3-1	15:54277	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91001623	MF-426
53/F-3-5	15:54278	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91001562	MF-421
IAEA-INFCIRC–					
335(Add.4)	15:53063	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91606180	
336(Add.5)	15:53063	*See* IAEA-INFCIRC–335(Add.4)			
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115(Rev.0)	15:54076	NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS		DE91601231	
39(Rev.5)	15:54420	NTIS (US Sales Only), PC A07/MF A01; OSTI; INIS		DE91602684	
97(Rev.0)	15:54075	NTIS (US Sales Only), PC A10/MF A01; OSTI; INIS		DE91601236	
IAEA-RL–					
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551	15:53389	NTIS (US Sales Only), PC A08/MF A01; OSTI; INIS		DE91605608	
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90/118	15:54205	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91605064	
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90/145	15:54250	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91604891	
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90/161	15:54207	NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS		DE91605065	

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90/42	15:54244	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91604922	
90/52	15:54201	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91605076	
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90/75	15:54203	NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS		DE91605066	
ICASE–					
90-41	15:54407	*See* AD-A–224407/7/XAB			
IEACR–					
13	15:52675	IEA Coal Research, 14-15 Lower Grosvenor Place, London, SW1W 0EX, England			PC-101; PC-116
27	15:53101	IEA Coal Research, Gemini House, 10-18 Putney Hill, London SW15 6AA, United Kingdom			
28	15:52954	IEA Coal Research, Gemini House, 10-18 Putney Hill, London, SW15 6AA, United Kingdom			
IEN-DEFI–					
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35-066	15:53102	NTIS (US Sales Only), PC A21/MF A01 - OSTI		DE88751891	
IFT-P–					
02/90	15:54047	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91604934	
12/89	15:54253	Available from the Library of the Comissao Nacional de Energia Nuclear, RJ, Brazil			
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796	15:53944	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91604986	
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804	15:53945	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91604987	
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813	15:54208	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91605078	
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147	15:53707	NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS		DE91605702	
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291	15:52892	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91605822	
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309	15:52766	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91605617	
310	15:53361	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91605539	
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4999	15:52654	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91001299	MF-102
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1409	15:53303	NTIS, PC A06/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91000740	MF-404
1415	15:53213	NTIS, PC A11/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91000750	MF-401
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1516	15:54211	NTIS, PC A06/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91001598	MF-401
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30-88	15:53645	Available from Fraunhofer-Institut fuer Systemtechnik und Innovationsforschung (ISI), Karlsruhe (Germany, F.R.)			
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325	15:52779	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91001039	MF-606
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JAERI-M–					
90-096	15:52990	NTIS (US Sales Only), PC A08/MF A01		DE91713044	
JAI–					
340	15:53410	*See* ORNL/Sub–89-SD841/3			
JINR-E–					
10-90-323	15:53040	NTIS (US Sales Only), PC A03/MF A01; OSTI; JINR, Publishing Department, Head Post Office, P.O. Box 79 101000 Moscow, USSR		DE91001200	
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2332	15:53305	NTIS (US Sales Only), PC A05/MF A01		DE91717317	
2354	15:53218	NTIS (US Sales Only), PC A07/MF A01		DE91717319	
2358	15:53306	NTIS (US Sales Only), PC A08/MF A01		DE91717318	
2361	15:52733	NTIS (US Sales Only), PC A07/MF A01		DE91717163	
2362	15:53219	NTIS (US Sales Only), PC A07/MF A01		DE91717223	
Juel-Conf–					
71	15:52991	NTIS (US Sales Only), PC A24/MF A01		DE91717019	
Juel-Spez–					
565	15:53012	NTIS (US Sales Only), PC A03/MF A01		DE91717161	

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
K/CSD/TM–					
89	15:53385	NTIS, PC A06/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91000512	MF-505
K/QT–					
382	15:52801	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91001314	MF-510
KCP–					
613-4253	15:53307	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91001036	PC-706
KFK-PEF–					
61-Vol.1	15:53845	NTIS (US Sales Only), PC A16/MF A01		DE91716972	
62	15:53846	NTIS (US Sales Only), PC A05/MF A01		DE91712335	
69	15:53771	NTIS (US Sales Only), PC A05/MF A01		DE91717160	
KURRI-TR–					
328	15:52970	NTIS (US Sales Only), PC A05/MF A01		DE91712930	
L–					
1613	15:52683	*See* PB–90-259524/XAB			
LA–					
11211-Vol.3	15:52716	NTIS, PC A07/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91000886	
11661-MS-Vol.1	15:53070	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91000515	PC-507
11851-MS	15:53772	NTIS, PC A06/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91000061	PC-702
11916-MS	15:54421	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91001717	
11918-MS	15:53261	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91001048	PC-703
11925-T	15:54217	NTIS, PC A10/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91000514	PC-411
11933-PR	15:52904	NTIS, PC A12/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91000513	MF-410
11939-MS	15:52897	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91000888	MF-700
11964-C	15:53500	NTIS, PC A14/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91000511	MF-413
LA-UR–					
90-2900	15:53580	NTIS, PC A02/MF A01 - OSTI		DE90016436	MF-906
90-2950	15:54218	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91000445	MF-910
90-2980	15:53224	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91000439	MF-910
90-2982	15:54219	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91000438	MF-910
90-3157	15:53869	NTIS, PC A01/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91000229	MF-903
90-3233	15:53450	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91000220	MF-404; MF-406
90-3269	15:53262	Addison-Wesley Publishing Co., Advanced Book Program, 350 Bridge Parkway, Redwood City, CA 94065			ND-704
90-3317	15:53312	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91000186	MF-904
90-3328	15:54256	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91000184	MF-910
LBL–					
29370	15:54360	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91000247	MF-404
29405	15:53979	NTIS, PC A04/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91000168	MF-414
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29484	15:53378	NTIS, PC A14/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91001740	MF-401; MF-404
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007/90	15:53418	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91605931	
026/89	15:53419	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91605932	
030/89	15:53420	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91605933	
034/89	15:53421	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91605934	
037/89	15:53422	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91605935	
042/89	15:53423	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91605936	
045/89	15:53424	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91605937	
LSTM–					
266/T/89	15:53585	Available from Erlangen-Nuernberg Univ., Erlangen (Germany, F.R.). Lehrstuhl fuer Stroemungsmechanik			
LU-TP–					
89-17	15:54027	NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS		DE91603047	
MAFF-FRDR–					
15	15:54179	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91605847	

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MIC–					
90-04368/XAB	15:53829	NTIS, PC EE07/MF E01			
90-04389/XAB	15:53565	NTIS, PC EE12/MF E01			
90-04390/XAB	15:53071	NTIS, PC EE12/MF E01			
90-04391/XAB	15:53072	NTIS, PC EE07/MF E01			
90-04392/XAB	15:53830	NTIS, PC EE07/MF E01			
90-04393/XAB	15:53015	NTIS, PC EE12/MF E01			
90-04394/XAB	15:53047	NTIS, PC EE07/MF E01			
90-04395/XAB	15:53023	NTIS, PC EE07/MF E01			
90-04396/XAB	15:53831	NTIS, PC EE07/MF E01			
90-04397/XAB	15:53773	NTIS, PC EE07/MF E01			
90-04406/XAB	15:52802	NTIS, PC EE17/MF E01			
90-04407/XAB	15:53832	NTIS, PC EE17/MF E01			
90-04553/XAB	15:53646	NTIS, PC EE07/MF E01			
90-04595/XAB	15:53647	NTIS, PC EE07/MF E01			
90-04604/XAB	15:53648	NTIS, PC EE12/MF E01			
90-04606/XAB	15:53649	NTIS, PC EE07/MF E01			
90-04667/XAB	15:53225	NTIS, PC EE07/MF E01			
90-04670/XAB	15:53226	NTIS, PC EE07/MF E01			
90-04756/XAB	15:53073	NTIS, PC EE07/MF E01			
90-04770/XAB	15:53650	NTIS, PC EE12/MF E01			
MLM-MU–					
90-69-0003	15:53313	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91001320	MF-706; MF-742
MRC/ABQ-R–					
1281	15:53599	*See* AD-A–224452/3/XAB			
MRC/NSH-N–					
89-002	15:53596	*See* AD-A–224279/0/XAB			
MRP/MRL–					
84-84(TR)	15:52681	Canada Centre for Mineral and Energy Technology, Ottawa, ON (Canada). Mineral Research Labs.			
MS–					
1115	15:53136	*See* PB–90-260522/XAB			
NASA-RP–					
1236	15:53295	*See* DOE/NASA/20320–76			
NBI-HE–					
90-29	15:54049	Available from Niels Bohr Inst., Copenhagen (Denmark)			
NBL–					
316	15:52900	NTIS, PC A06/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91000584	MF-940
NCAR/TN–					
352+STR	15:53894	*See* PB–90-265166/XAB			
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1TP4B-90009-(Vol.2)	15:53074	NTIS (US Sales Only), PC A16/MF A01		DE90706234	
1TP4B-90009-(Vol.3)	15:53075	NTIS (US Sales Only), PC A18/MF A01		DE90706235	
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8917	15:52934	NTIS (US Sales Only), PC A04/MF A01		DE91715393	
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0009	15:53031	*See* CNIC–00272			
NINF–					
0004	15:53256	*See* CNIC–00359			
NIR–					
2/88	15:53652	NTIS (US Sales Only), PC A04/MF A01		DE91717159	
NRC-C–					
1147-885	15:52660	National Research Council of Canada, Ottawa, ON (Canada). Div. of Chemistry			
NRRI–					
90-14	15:52750	OSTI; National Regulatory Research Institute, 1080 Carmack Road, Columbus, OH 43210		TI91001191	
NSRFC–					
33125	15:52639	CANMET, Technical Information Service, 562 Booth St., Room 20C, Ottawa, ON, Canada K1A 0G1			

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NTP-TR–					
371	15:53849	*See* PB–90-256371/XAB			
NU–					
0003	15:54016	*See* CNIC–00260			
0004	15:53931	*See* CNIC–00303			
0005	15:54234	*See* CNIC–00313			
NUREG–					
0540-Vol.12-No.8	15:53024	NTIS, PC A14/MF A01 - GPO; OSTI; INIS		TI91001540	
0750-Vol.32-No.2	15:53025	NTIS, PC A05/MF A01 - GPO; OSTI; INIS		TI91001546	
1383	15:52803	NTIS, PC A03/MF A01 - GPO; OSTI; INIS		TI91001249	
1403	15:53077	NTIS, PC A03/MF A01 - GPO; OSTI; INIS		TI91001104	
1417	15:53078	NTIS, PC A03/MF A01 - GPO - OSTI		TI91001319	
1423-Vol.1	15:52804	NTIS, PC A06/MF A01 - GPO - OSTI		TI91001195	
NUREG/CP–					
0107	15:54396	NTIS, PC A13/MF A01 - GPO - OSTI		TI91000777	
0113	15:53079	NTIS, PC A10/MF A01 - GPO; OSTI; INS		TI91000893	
NUREG/CR–					
5314-Vol.3	15:52971	NTIS, PC A04/MF A01 - GPO; OSTI; INIS		TI91001739	
5507	15:53080	NTIS, PC A05/MF A01 - GPO; OSTI; INIS		TI91001242	
5605	15:52972	NTIS, PC A03/MF A01 - GPO; OSTI; INIS		TI91001719	
NWC-TP–					
6981	15:53917	*See* AD-A–224270/9/XAB			
7056	15:52941	*See* AD-A–224275/8/XAB			
NWRA-CR–					
90-R060	15:53919	*See* AD-A–224392/1/XAB			
NYSERDA–					
90-8	15:53148	OSTI, PO Box 62, Oak Ridge, TN 37831; OSTI; New York State Energy Research and Development Authority, Two Rockefeller Plaza, Albany, NY 12223		TI91001297	
90-11	15:53149	OSTI; New York State Energy Research and Development Authority, Two Rockefeller Plaza, Albany, NY 12223		TI91001298	
NZERDC-P–					
120	15:52640	Ministry of Commerce, Energy and Resources Division, P.O. Box 2337, Wellington, New Zealand			
ORNL–					
6086/V1	15:54368	NTIS, PC A99/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91000527	MF-411
6603	15:53314	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91000544	MF-222
6608/R6	15:53106	NTIS, PC A06/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91000547	MF-630
6608/R7	15:53107	NTIS, PC A06/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91001005	MF-630
6608/R8	15:53108	NTIS, PC A06/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91000537	MF-630
6618	15:52905	NTIS, PC A06/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91000545	MF-413
6621	15:53833	NTIS, PC A07/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91000521	PC-407
6625	15:52914	NTIS, PC A06/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91001012	MF-242
6637	15:53591	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91000540	
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ORNL/CON–					
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90/1	15:52641	NTIS, PC A21/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91001158	MF-114
ORNL/FTR–					
3687	15:53013	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91001155	MF-400
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3773	15:53362	NTIS, PC A01/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91001150	MF-406
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3775	15:54279	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91001152	MF-420
3778	15:53130	NTIS, PC A01/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91000872	MF-400
3783	15:53263	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91001526	MF-404
3784	15:53109	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91001372	MF-630
3786	15:53947	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91001201	MF-406
3788	15:54369	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91001528	MF-423
3797	15:53566	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91001527	MF-413
ORNL/M–					
1225	15:54351	*See* DOE/ER–0313/8			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
ORNL/M–					
1245	15:53150	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91000536	MF-350
1248	15:53187	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91000516	PC-332
1267	15:53151	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91000541	MF-350
983	15:53227	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91000530	MF-400
ORNL/Sub–					
87-00184/02	15:53185	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91001156	MF-114
87-SB047C/1	15:53264	NTIS, PC A06/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91000535	MF-332
88-SC006/1	15:52915	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91000550	MF-242
89-SD841/3	15:53410	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91000520	PC-513; PC-812
ORNL/TM–					
11039	15:52642	NTIS, PC A10/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91000922	MF-114
11130	15:54423	NTIS, PC A07/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91001014	MF-405
11161	15:53017	NTIS, PC A07/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91000524	PC-530
11262	15:53586	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91000522	PC-506
11275	15:53592	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91000533	
11287-Rev.1	15:54445	NTIS, PC A10/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91001315	MF-400
11324	15:53081	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91001002	MF-400
11339	15:53152	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91001009	MF-350
11354	15:53602	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91001010	
11383	15:53175	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91000539	
11406	15:53176	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91000892	MF-407; MF-402
11412	15:53603	NTIS, PC A06/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91001020	
11465	15:52643	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91001001	MF-103; MF-109; MF-114
11466	15:52777	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91000938	MF-523
11489	15:53161	NTIS, PC A21/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91001004	MF-332
11496	15:54424	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91000531	MF-405
11503	15:53587	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91001007	MF-506
11521	15:54280	NTIS, PC A05/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91000519	PC-427
11522	15:53265	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91000518	PC-404
11554	15:52805	NTIS, PC A04/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91001019	MF-810
11555	15:52806	NTIS, PC A05/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91001022	MF-812
11562	15:54370	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91000517	PC-427
11567	15:53131	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91001015	
11583	15:54446	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91001006	
11593	15:53195	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91001017	MF-404
11595	15:54447	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91001024	
11596	15:53162	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91001016	
11602	15:53153	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91000538	MF-350
11615	15:52907	NTIS, PC A07/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91000548	MF-243
11618	15:53834	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91000532	MF-402
11621	15:52972	*See* NUREG/CR–5605			
11622	15:53189	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91000543	MF-334
11634	15:54425	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91001058	MF-405
11639	15:54426	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91000534	
11652	15:52807	NTIS, PC A10/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91001021	MF-721
OY/PSTL-TIED–					
68	15:52682	NTIS (US Sales Only), PC A03/MF A01		DE91707434	
69	15:52620	NTIS (US Sales Only), PC A04/MF A01		DE91707436	
71	15:52693	NTIS (US Sales Only), PC A06/MF A01		DE91707438	
PATENTS-USA–					
4,897,579/A/	15:53289	Patent and Trademark Office, Box 9, Washington, DC 20232 (USA)			
4,933,241/A/	15:54231	Patent and Trademark Office, Box 9, Washington, DC 20232 (USA)			
4,942,135/A/	15:53703	Patent and Trademark Office, Box 9, Washington, DC 20232 (USA)			
4,942,297/A/	15:53704	Patent and Trademark Office, Box 9, Washington, DC 20232 (USA)			
4,943,494/A/	15:53140	Patent and Trademark Office, Box 9, Washington, DC 20232 (USA)			
4,945,176/A/	15:53483	Patent and Trademark Office, Box 9, Washington, DC 20232 (USA)			
4,945,810/A/	15:54393	Patent and Trademark Office, Box 9, Washington, DC 20232 (USA)			
4,945,953/A/	15:53481	Patent and Trademark Office, Box 9, Washington, DC 20232 (USA)			
4,946,643/A/	15:53288	Patent and Trademark Office, Box 9, Washington, DC 20232 (USA)			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
4,947,223/A/	15:53482	Patent and Trademark Office, Box 9, Washington, DC 20232 (USA)			
4,947,340/A/	15:53381	Patent and Trademark Office, Box 9, Washington, DC 20232 (USA)			
4,947,480/A/	15:54443	Patent and Trademark Office, Box 9, Washington, DC 20232 (USA)			
Application7-540,598	15:52649	NTISPC N03/MF A01			
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Application7-531,422	15:53484	NTISPC N03/MF A01			
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90-214966/XAB	15:53774	NTIS, PC A14/MF A02			
90-215419/XAB	15:53655	NTIS, PC A09/MF A01			
90-234741/XAB	15:53708	NTIS, PC A12/MF A02			
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90-238437/XAB	15:53847	NTIS, PC A08/MF A01			
90-242876/XAB	15:53110	NTIS, PC EE99/MF E99			
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90-242892/XAB	15:53712	NTIS, PC A04/MF A01			
90-242900/XAB	15:53713	NTIS, PC A10/MF A02			
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90-243015/XAB	15:53724	NTIS, PC A07/MF A01			
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90-243130/XAB	15:53111	NTIS, PC EE99/MF E99			
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90-258492/XAB	15:53112	NTIS, PC A99/MF A04			
90-258872/XAB	15:53657	NTIS, PC A09/MF A01			

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90-259714/XAB	15:53658	NTIS, PC EE99/MF E99			
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90-259748/XAB	15:53661	NTIS, PC A23/MF A03			
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90-259789/XAB	15:53167	NTIS, PC A06/MF A01			
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90-265166/XAB	15:53894	NTIS, PC A06/MF A01			
90-265208/XAB	15:53785	NTIS, PC A99/MF E14			
90-265406/XAB	15:52725	NTIS, PC A03/MF A01			
90-265448/XAB	15:52726	NTIS, PC A03/MF A01			
90-265554/XAB	15:52727	NTIS, PC A04/MF A01			
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90-266610/XAB	15:52728	NTIS, PC A03/MF A01			
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8908	15:54011	NTIS (US Sales Only), PC A04/MF A01		DE91716293	
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90-8	15:54353	*See* DOE/ET/51013–T231			
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4253	15:53228	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91000503	PC-704

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90-2551C	15:54223	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91001265	MF-704
90-2579C-Draft	15:54375	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91001340	
90-2589C	15:54450	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91000866	MF-700
90-2596C	15:53870	NTIS, PC A01/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91000967	MF-702
90-7030	15:52928	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91000468	MF-274

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90-8204	15:53234	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91000489	MF-506
90-8486	15:53425	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91000490	MF-700
SCIENTIFIC–					
2	15:53885	*See* AD-A–224395/4/XAB			
SEI/CM–					
24	15:54402	*See* AD-A–223897/0/XAB			
SERI/TP–					
211-3934	15:52929	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90000378	MF-270
232-3820	15:52930	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90000367	MF-244
253-3594	15:52935	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89009504	MF-262
257-3983	15:52947	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91002101	MF-261
260-3881	15:53157	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90000369	MF-233
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257-3372	15:52948	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89000879	MF-261
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0030	15:54233	*See* CNIC–00281			
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0034	15:54265	*See* CNIC–00305			
0035	15:53545	*See* CNIC–00311			
SLAC-PUB–					
5293	15:53527	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91001031	MF-414
5320	15:53528	NTIS, PC A01/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91001029	MF-414
5321	15:53529	NTIS, PC A01/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91001028	MF-414
5322	15:53530	NTIS, PC A01/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91001027	MF-414
5325	15:53531	NTIS, PC A01/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91000056	MF-406
5329	15:53492	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91001030	MF-403
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0031	15:54173	*See* CNIC–00302			
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0033	15:53816	*See* CNIC–00314			
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90-14	15:54429	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91001358	MF-405
90-15	15:54430	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91001359	MF-405
SOV–					
90-10021	15:53115	*See* PB–90-928107/XAB			
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90-275-6411-10	15:53656	*See* PB–90-257791/XAB			
90-683-6657-XXV	15:52958	*See* DOE/PC/88867–T8			
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49-5/5-3E	15:53648	*See* MIC–90-04604/XAB			
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A615	15:52933	NTIS (US Sales Only), PC A02/MF A01		DE91707473	
A617	15:52939	NTIS (US Sales Only), PC A03/MF A01		DE91707475	
A640	15:53098	NTIS (US Sales Only), PC A03/MF A01		DE91707477	
A651	15:52940	NTIS (US Sales Only), PC A03/MF A01		DE91707478	
A657	15:52931	NTIS (US Sales Only), PC A04/MF A01		DE91707481	
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298	15:54408	*See* AD-A–224431/7/XAB			
4471-058-90	15:53173	*See* DOE/CE/26593–1			
6408-160-89	15:53169	*See* PB–90-260548/XAB			
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1255	15:53114	*See* PB–90-267303/XAB			
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312	15:52925	NTIS (US Sales Only), PC A06/MF A01		DE91707452	
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86-055	15:53858	Copy held by UB/TIB Hannover			
90-009/15	15:52667	Copy held by UB/TIB Hannover			
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90-009/7	15:52666	Copy held by UB/TIB Hannover			
UCID–					
16986-90-1/2	15:52753	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91000497	MF-123
20622-90-1	15:53235	NTIS, PC A06/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91000495	MF-704
UCRL–					
102683	15:53083	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91001356	MF-400
21001-90-1	15:53859	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91000802	MF-702
52000-90-9	15:53871	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91001026	PC-700
53943-89	15:53196	NTIS, PC A09/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91000510	PC-700
98069	15:53597	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91000817	MF-706
UCRL-CR–					
103819	15:54376	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91000948	MF-712
104813	15:54377	NTIS, PC A01/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91001580	MF-422
104838	15:53433	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91000952	MF-706
104962	15:54224	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91000951	MF-700
106119	15:54378	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91001681	MF-422
UCRL-ID–					
103432	15:54431	NTIS, PC A07/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91000498	MF-705
103928	15:53319	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91000501	MF-704
104836	15:53582	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91000066	MF-406
105097	15:53593	NTIS, PC A07/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91000496	
106018	15:52759	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91001055	MF-123
106075	15:54451	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91000494	MF-705
106077	15:54432	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91000499	MF-405
UCRL-JC–					
103354	15:53456	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91001685	MF-700
103491	15:54379	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91001743	MF-404
103754	15:54433	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90010655	MF-706
103798	15:53532	NTIS, PC A01/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91001747	MF-700
103883	15:54282	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91000418	MF-713
103946	15:53163	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91000412	
103980	15:54434	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90011461	MF-405
104150	15:53948	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91001742	MF-712
104151	15:54435	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90012994	MF-705
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104756	15:52814	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91000812	MF-814
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104817	15:53835	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91000809	MF-408
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105000	15:54381	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91000281	MF-700
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106057	15:53907	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91001745	MF-700
106069	15:53951	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91001757	MF-700
106177	15:54123	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91000971	MF-712
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01/90	15:54258	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91604909	
02/90	15:54259	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91604910	
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90-05	15:53790	*See* AD-A–224444/0/XAB			

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USGS-OFR-					
88-664	15:53874	USGS-OFR, USGS Open File Service, Box 25425-Denver Federal Center, Denver CO 80225			ND-814
89-446	15:53875	USGS-OFR, USGS Open File Service, Box 25425-Denver Federal Center, Denver, CO 80225			ND-814
USGS/MAP/I-					
1884	15:53872	INIS; US Geological Survey, Map Distribution, Federal Center, Box 25286, Denver, CO 80225			MF-814
2049	15:53873	USGS-OFR, U.S.G.S. Open File Service, Box 25425-Denver Federal Center, Denver, CO 80225			ND-814
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02/90	15:54226	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91605067	
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685	15:53236	NTIS (US Sales Only), PC A03/MF A01		DE91707462	
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8904-V/5	15:53188	NTIS (US Sales Only), PC A03/MF A01		DE91717006	
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0142-4	15:53787	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91001351	MF-903
0188	15:52815	NTIS, PC A06/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91001286	MF-814
0299	15:53764	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91001289	MF-902
0342	15:52816	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91001175	MF-902
0342-Add.10	15:52825	NTIS, PC A05/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91001174	MF-902
0342-Add.11	15:52826	NTIS, PC A05/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91001181	MF-902
0342-Add.12	15:52827	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91001178	MF-902
0342-Add.13	15:52828	NTIS, PC A09/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91001185	MF-902
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0342-Add.30	15:52840	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91001186	MF-902
0342-Add.31	15:52841	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91001187	MF-902
0342-Add.32	15:52842	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91001169	MF-902
0342-Add.4	15:52819	NTIS, PC A04/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91001166	MF-902
0342-Add.5	15:52820	NTIS, PC A06/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91001164	MF-902
0342-Add.6	15:52821	NTIS, PC A05/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91001159	MF-902
0342-Add.7	15:52822	NTIS, PC A05/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91001160	MF-902
0342-Add.8	15:52823	NTIS, PC A07/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91001161	MF-902
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0348	15:52843	NTIS, PC A05/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91001284	MF-902
0348-Suppl.1	15:52844	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91001301	MF-902

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WHC-EP–					
0350	15:52845	NTIS, PC A08/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91001171	MF-940
0372-Vol.1	15:53700	NTIS, PC A19/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91000775	MF-902
0377-Rev.1	15:52899	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91001287	MF-940
WHC-SA–					
0832	15:54438	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91001280	MF-900
0916	15:54383	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91001189	MF-530
0924	15:53019	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91001288	MF-535
0934	15:52782	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91001282	MF-902
0935	15:52783	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91001283	MF-902
0948	15:53020	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91001281	MF-530
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0976	15:53041	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91001177	MF-530
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0464-Rev.1	15:52846	NTIS, PC A08/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91001285	MF-721
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1080	15:53414	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91001044	PC-506
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90-158	15:53426	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91000784	MF-706
90-70	15:53788	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91000783	MF-702
90-94	15:53093	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91000785	MF-706
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89-1442	15:52847	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91000778	MF-721
89-313	15:53701	NTIS, PC A06/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91000508	PC-702
90-421	15:53836	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91000507	PC-702
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0003	15:52765	*See* CNIC–00297			
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Order Number Correlation

The correlation list is provided for those organizations that file documents by report number but may receive requests by order number. For more information about a document, refer to the Report Number Index.

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Reference Department
325 Don Gaspar Avenue
Santa Fe, NM 87501
(505) 827-2033, ext. 22

NEW YORK STATE LIBRARY
Empire State Plaza
Albany, NY 12230
(518) 474-5563

UNIVERSITY OF NORTH CAROLINA AT CHAPEL HILL
Wilson Library
BA/SS Documents Division
Chapel Hill, NC 27515
(919) 962-1321

UNIVERSITY OF NORTH DAKOTA
Chester Fritz Library
Documents Department
Grand Forks, ND 58202
(701) 777-2617, ext. 27
(in cooperation with North Dakota State Univ. Library)

STATE LIBRARY OF OHIO
Documents Department
65 South Front Street
Columbus, OH 43215
(614) 462-7051

OKLAHOMA DEPT. OF LIBRARIES
Government Documents
200 NE 18th Street
Oklahoma City, OK 73105
(405) 521-2502

OKLAHOMA STATE UNIV. LIB.
Documents Department
Stillwater, OK 74078
(405) 624-6546

PORTLAND STATE UNIV. LIB.
Documents Department
P.O. Box 1151
Portland, OR 97207
(503) 229-3673

STATE LIBRARY OF PENN.
Government Pub. Section
P.O. Box 1601
Harrisburg, PA 17105
(717) 787-3752

TEXAS STATE LIBRARY
Public Services Department
P.O. Box 12927-Cap. Sta.
Austin, TX 78753
(512) 471-2996

TEXAS TECH. UNIV. LIBRARY
Govt. Documents Department
Lubbock, TX 79409
(806) 742-2268

UTAH STATE UNIVERSITY
Merrill Library, U.M.C. 30
Logan, UT 84322
(801) 750-2682

UNIVERSITY OF VIRGINIA
Alderman Lib.-Public Doc.
Charlottesville, VA 22901
(804) 924-3133

WASHINGTON STATE LIBRARY
Documents Section
Olympia, WA 98504
(206) 753-4027

WEST VIRGINIA UNIV. LIB.
Documents Department
Morgantown, WV 26506
(304) 293-3640

MILWAUKEE PUBLIC LIBRARY
814 West Wisconsin Avenue
Milwaukee, WI 53233
(414) 278-3000

ST. HIST. LIB. OF WISCONSIN
Government Pub. Section
816 State Street
Madison, WI 53706
(608) 262-4347

WYOMING STATE LIBRARY
Supreme Ct. & Library Bld.
Cheyenne, WY 82002
(307) 777-6344

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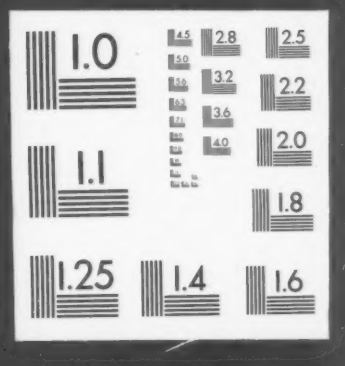
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